Building for Health

Capital Sustainability

MC0356

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BUILDING FOR HEALTH

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Foreword

Action to promote sustainability and sustainable development are a key part of the role that the NHS needs to play if it is to be a good corporate citizen.

We are currently undertaking the most extensive facility modernisation programme the NHS has ever seen; in excess of £20 billion over the next 10 years through a combination of public private partnerships and public capital funding.

This level of investment, as well as providing modern, fit for purpose new healthcare facilities, has the potential to contribute significantly to the regeneration of local communities, providing local employment opportunities and wider environmental benefits.

I believe action to harness these wider benefits will strengthen the work of the NHS in promoting good health, tackling health inequalities and in providing modern and efficient healthcare services for our communities.

In 2002, whilst working with Sue Atkinson in the then London Regional Office, we instigated a study entitled "Building for Health" which set out the strategic case for the NHS in London to contribute to sustainable development.

The NHS in London has worked together to provide further guidance on how sustainable development can be promoted in a practical way; through resources to assist Trusts and PCTS to plan these measures throughout a procurement process. The resources contained in this folder provide an excellent start for all projects being planned or under procurement.

All Business Cases for investment need to address the issues set out in Building for Health.

This is an important initiative which will demonstrate the leadership in this field that the NHS needs to take if we are to extract the maximum benefit from our major investment programme.

John Bacon
Group Director
Health and Social Care Services Delivery
Department of Health

BUILDING FOR HEALTH

THE ADVISORY NAVIGATION TOOL

The Advisory Navigation Tool (ANT) provides a set of useful references when considering sustainability across four key areas:

- General Sustainability;
- Environmental;
- Social Sustainability, and;
- Economic Sustainability.

ANT is a simple, spreadsheet-based tool. A paper copy is included in this section for easy reference and a CD-Rom with an electronic copy of ANT is also included in this guidance folder.

The electronic version contains hyper-text links to the websites of the sponsoring organisations for the publications identified in the "Access" column.

This column also contains comments embedded in the spreadsheet to enable the user to quickly and easily assess the information that is available on that website.

The spreadsheet is read-only to ensure version control. It is the intention that ANT will grow and develop over time. If you, as a user, identify material which you think would be of value to include please send an e-mail to Duane Passman, Head of the Capital Investment Unit for the London Strategic Health Authorities: Duane.Passman@nwlha.nhs.uk

ANT will be updated regularly to reflect developing policy and good practice.

BUILDING FOR HEALTH

ADVISORY NAVIGATION TOOL

April 2005

Issue	Title	Source	Access	Output Specification		Contract		Reporting	
				Target	Measure	Target	Measure	Client	Public
General Sustainability									
PFI and Sustainability									
	Green Public Private Partnerships - A guidance note on how to include environmental considerations within PPPs and PFI projects	ODPM, 2002	http://pfi.ogc.gov.uk/Download.asp?id=711&field=5&filename=Green+Guidance%2Epdf						
	Sustainability lessons from private finance and similar private initiatives	BRE, 2002	http://www.brebookshop.com/details.jsp?id=140225						
	Sustainable PFI - Contracts and Incentives	CIEF, 2003	http://www.ciria.org/cief_events_notes.htm						
Construction									
	Achieving Excellence in Construction: Procurement Guide 11: Sustainability	Office of Government Commerce, 2005	http://www.ogc.gov.uk/sdtoolkit/reference/achieving/AE11.pdf						
	A client's guide to greener construction	Ciria	http://www.ciria.org/acatalog/SP120.html						
	A Sustainability Checklist for Developments	BRE	http://projects.bre.co.uk/envdiv/planning_sustainability/SustainabilityChecklist.pdf						
	Assessing environmental impacts of construction - Industry consensus	BREEAM and UK Ecopoints, 2000	http://www.brebookshop.com/details.jsp?id=32982						
	Sustainable Construction	DTI	http://www.dti.gov.uk/construction/sustain/						
	Construction Best Practise	Construction Best Practise Programme	www.cbpp.org.uk						
	Green Construction		http://www.greenconstruction.co.uk/						
	Considerate Constructors Scheme		http://www.ccscheme.org.uk/						
	CIRIA Construction Guidance notes	CIRIA	www.ciria.org.uk						
Measurement									
	NHS Environmental Assessment Tool (NEAT)	NHS Estates	http://www.nhsestates.gov.uk/sustainable_development/content/neat.html						
	Towards a framework for environmental assessment of building materials and components	BRE	http://www.brebookshop.com/details.jsp?id=651						
	Design Quality Indicator (DQI).		www.dqi.org.uk						
	CSR & environmental/social auditing	NHS PASA	http://www.pasa.doh.gov.uk/sustainabledevelopment/social/corporate_social_responsibility.stm						
Other									
	Sustainable Development in the NHS	NHS Estates	http://www.nhsestates.gov.uk/sustainable_development/index.asp						
	Sustainable Development in the NHS (0113224532)	NHS Estates, 2001: 6	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113224532						
	The New Environmental Strategy for the NHS	NHS Estates 2001:12	http://www.nhsestates.gov.uk/download/publications_guidance/envstrat.pdf						
	Sustainable Development - the UK governments approach		http://www.sustainable-development.gov.uk/uk_strategy/factsheets/health/						
	Claiming the Health Dividend (185717464X)	The Kings Fund 2001	http://www.kingsfund.org.uk/						
	2020 vision: our future healthcare environments.	CABE 2002	http://www.cabe.org.uk/publications/						
	The Architectural Healthcare Environment (011322480X)	NHS Estates	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=011322480X						
	Environmental Code of Practice for Buildings and their Services - Environmental case Studies, Volume 2 (CS	BSRIA, 1999	http://www.bsria.co.uk/bookshop/system/index.html						
	Environment, Construction, and Sustainable Development	2001	http://www.environmental-expert.es/resulteachpublication.asp?codi=2682						
	The Sustainable Development Commission		http://www.sd-commission.gov.uk/						
Environmental Sustainability									
Waste									
general	Purchasing Waste Management Services for the NHS	PASA	http://www.pasa.doh.gov.uk/sustainabledevelopment/environment/docs/waste_mgt_leaflet.doc						
waste reduction					x		x	x	
	Healthcare Waste Minimisation - a Compendium of Good Practice	DoH, 2000	http://www.info.doh.gov.uk/doh/point.nsf/Publications?ReadForm						
	Reducing Food Waste in the NHS (0113224397)	NHS Estates, 2000:3	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113224397						
	Finding Hidden Profits - 200 Tips for Reducing Waste (EN030)	Environmental Technology Best Practise Programme, 1999	http://www.envirowise.gov.uk/envirowisev3.nsf/TextKey/DBRY4PHFDF?OpenDocument						

	Profiting from Practical Waste Minimisation: Running a workshop to Maintain the Momentum (GG174)	Environmental Technology Best Practise Programme, 1999	http://www.envirowise.gov.uk/envirowisev3.nsf/TextKey/DBRY4PHJ4D?OpenDocument						
	Waste minimisation on a construction site		http://www.brebookshop.com/details.jsp?id=32983						
	Demonstrating waste minimisation benefits in construction (CS36)	Ciria	http://www.ciria.org/acatalog/C536.html						
waste reuse									
	Reclamation and recycling of building materials: industry position report	BRE	http://www.brebookshop.com/details.jsp?id=30334		x		x	x	
	Deconstruction and reuse of construction materials	BRE	http://www.brebookshop.com/details.jsp?id=46471						
waste recycling									
	Waste minimisation and recycling in construction (SP122)	Ciria: Review (SP122), Boardroom Handbook (SP135), Site Guide	http://www.ciria.org/acatalog/SP122.html	x	x	x	x	x	x
	Onsite waste recycling	Whipps Cross Hospital	http://www.whippsx.co.uk/development.htm						
	The reclaimed and recycled construction materials handbook (C513)		http://www.ciria.org/acatalog/copy_of_C513.html						
	Materials Recycling	London Remade	http://www.londonremade.com/london_remade/index.asp						
waste storage & segregation									
	Waste Prevention Guide	NHS	http://www.nhsestates.gov.uk/sustainable_development/content/waste/flowchart.html		x		x		
clinical waste									
	Getting Sorted: the Safe and Economic Management of Hospital Waste (1862400172)	Audit Commission, 1997	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=1862400172		x		x	x	
	A Strategic Guide to Clinical Waste Management (0113223331)	NHS Estates 1999	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223331						
special waste									
	A guide to special waste regulations 1996	Environment Agency, 2001	http://www.environment-agency.gov.uk/commondata/105385/specwaste.pdf		x		x	x	
Energy & Emissions									
general	NHS Estates - Low Energy Hospitals	NHS Estates	http://www.tso.co.uk/bookshop/bookstore.asp?action=searchresults						
	The Utilisation of Energy in Hospitals	Faber Maunsell, 2004	Contact Faber Maunsell for details 020 8784 5784						
	Sustainable Development:Energy	NHS Estates	http://www.nhsestates.gov.uk/sustainable_development/content/energy.html						
	Energy consumption in public and commercial buildings	BRE	http://www.brebookshop.com/details.jsp?id=1129						
	Energy monitoring & metering	BRE	http://www.bre.co.uk						
	Envest is a software tool that simplifies the otherwise very complex process of designing environmentally friendly buildings - focusing specifically on embodied energy	BRE	http://www.bre.co.uk/service.jsp?id=52						
energy efficiency/reduction				x	x	x	x	x	
	Achieving Energy Efficiency in New Hospitals (0113223390)	NHS Estates, 1994	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223390						
	Action Energy Website	Action Energy	www.actionenergy.org.uk						
	Low Energy Hospitals: Wansbeck General Hospital, Ashington, Northumberland: 1st year appraisal (0113223447)	NHS Estates, 1995	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223447						
	Low Energy Hospitals- St Mary's Hospital, Isle of Wight (1st and 2nd year appraisals and final report)	NHS Estates, 1999	http://www.tso.co.uk/bookshop/bookstore.asp						
	A Strategic Guide to Energy Management for General Managers and Chief Executives (0113223307)	NHS Estates 1991, 1994	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223307						
	Effective Heat and Power Strategies for Healthcare Premises (0113217358)	NHS Estates	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113217358						
	Reducing Energy Consumption in Oversized Plants (0113221630)	NHS Estates	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113221630						
	Improving energy efficiency		http://www.brebookshop.com/details.jsp?id=33082						
	Greening the Building and the Bottom Line: Increasing Productivity through Energy Efficient Design	Tomm, J and Browning, W, Rocky Mountain Institute, 1994	http://www.rmi.org/store/pid963.php						
	HVAC Troubleshooting - guide to solving indoor environmental and energy consumption problems (AG 13/99)	Fletcher, J (BSRIA 1999)	http://www.bsria.co.uk/bookshop/system/index.html						
alternative energy sources/renewable sources				x	x	x	x	x	x
	A Strategic Guide to Combined Heat and Power	NHS Estates 1993	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223323						
	Building Services Research and Information Association (BSRIA)		http://www.bsria.co.uk						
	Photovoltaics: integration into buildings	BRE	http://www.brebookshop.com/details.jsp?id=919						
air quality					x		x		
	Refurbishment for Natural Ventilation (0113221622)	NHS Estates, 1998	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113221622						
	Climate and site development, Part 3: improving microclimate through design	BRE	http://www.brebookshop.com/details.jsp?id=832						
	Building Services Research and Information Association (BSRIA)		http://www.bsria.co.uk/						
Biodiversity/Ecology									
impact assessment				x	x	x	x	x	x

	Biodiversity indicators for construction projects	Ciria	http://www.ciria.org.uk/pdf/w005.pdf					
habitat					x	x	x	x
	Urban Habitats	Wildlife Trust	http://www.wildlifetrusts.org/					
	Support and enhance existing ecology (e.g. green roofs)		http://www.wbdg.org/design/resource.php?cn=0&rp=41					
	Landscaping maintenance		http://www.soilassociation.org/web/sa/saweb.nsf/Open					
Water								
reducing water use					x	x		
	Water conservation	BRE	http://www.brebookshop.com/details.jsp?id=1116					
water reuse					x	x	x	
	Water Conservation - implications of using recycled greywater and stored rainwater in the UK	Mustow S, Grey R (BSRIA, 1991)	http://www.bsria.co.uk/					
	Rainwater and greywater use in buildings. Best practice guidance (C539)	Ciria	http://www.ciria.org/acatalog/C539.html					
	Rainwater and greywater use in buildings. Decision-making for water conservation (PR080)	Ciria	http://www.ciria.org/acatalog/PR080.html					
emmissions to water					x	x	x	x
	Control of water pollution from construction sites. Guidance for consultants and contractors (C532)	Ciria	http://www.ciria.org/acatalog/C532.html					
Environmental Management								
general	Environmental Management in Healthcare (0113217730)	NHS Estates, 1995	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113217730					
	A Strategic Guide to Environment Policy (0113223455)	NHS Estates, 1999	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113223455					
user community perception surveys					x	x	x	x
	Clinical Governmance	Commission for Health Improvement	http://www.chi.nhs.uk/eng/cgr/overview.shtml					
Design								
quality & standards					x	x		
	Improving Standards of Design in the Procurement of Public Buildings.	CABE 2002	http://www.cabe.org.uk/publications/					
	The value of good design: public perception.	CABE 2002	http://www.cabe.org.uk/publications/					
	Design Quality of selected PFI hospitals	MARU, 2000	http://www.lsbu.ac.uk/maru/about/recent_projects.html					
	The value of good design - A Bibliography (a systematic attempt to collate research that examines the 'value added by good design in five key areas: · Health · Education · Crime (& safety) · Housing · Social inclusion (&	CABE 2001	http://www.cabe.org.uk/publications/					
	Site layout planning for daylight and sunlight: a guide to good practice	BRE	http://www.brebookshop.com/details.jsp?id=504					
Social Sustainability								
Education								
professional education					x	x	x	x
	Best Practise Case Study	Whipps Cross	http://www.whippsx.co.uk/development.htm					
Leisure								
liesure facilities					x	x	x	x
	Best Practise Case Study	Whipps Cross	http://www.whippsx.co.uk/development.htm					
Access to green space								
general	Gardens in Healthcare Facilities: Uses, theraputic benefits and design.	Marcus CC, Barnes, 1995	http://www.healthdesign.org/heal_gardens.html					
	Common Activity Spaces Volumes 1-4	NHS Estates	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113221843					
Design								
general	Better Public Buildings.	CABE with DCMS and the Office of Government Commerce, 2000	http://www.cabe.org.uk/publications/					
	Creating Excellent Buildings: A Guide for Clients.	CABE 2003	http://www.cabe.org.uk/publications/					
	Better Design (0113217579)	NHS Estates 1994	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113217579					
impact of buildings					x	x		
	Building a Better Patient Environment (Initiative)	Princes Foundation	http://www.princes-foundation.org/foundation/BuildingDesign.html					
	An Investigation to determine whether the built environment affects patients' medical outcomes	Centre for Health Care Design, 1996	http://www.healthdesign.org/pat_med_outcomes.html					
	Design against crime: a strategic approach to hospital planning (0113217366)	NHS Estates June 1994	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113217366					
Community engagement								
general	Estatecode Environments for Quality Care: Health buildings in the community	NHS Estates 1994	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113217641					
	Community Safety	Whipps Cross	http://www.whippsx.co.uk/development.htm					
health inequalities								x

	Independent Inquiry into inequalities in Health: The Acheson Report	The Stationary Office, 1998	http://www.archive.official-documents.co.uk/document/doh/ih/ih.htm						
	Tackling Health Inequalities - A programme for Action	DoH 2003	http://www.doh.gov.uk/healthinequalities/programmeforaction/index.htm						
	Health and Neighbourhood Renewal-guidance from the Department of Health and the Neighbourhood Renewal Unit	2002	http://www.doh.gov.uk/healthinequalities/healthandneighbourhood.htm						
public involvement									x
	Best Practise Case Study	Whipps Cross	http://www.whippsx.co.uk/development.htm						
	Creating Involvement - a Handbook of Tools and Techniques for Effective Community Involvement	Improvement and Development Agency, Environment Trust	Environment Trust 0207 264 4660						
Transport									
general	The Healthy Transport Toolkit: a Guide to reducing car trips to NHS facilities, (HSC 1998/181)	Department of Health, 1998	http://www.transport2000.org.uk/						
	A Travel Plan Resource Pack for Employers: an Essential Guide to Developing, Implementing and Monitoring a Travel Management Strategy for your Organisation	DETR, 2000	http://www.dft.gov.uk/stellent/groups/dft_localtrans/documents/page/dft_localtrans_504132.hcsp						
	Transport Energy Best Practise		http://www.transportenergy.org.uk/bestpractice/						
site vehicles					x		x	x	x
	Healthy Transport	Transport 2000 (Dft)	http://www.dft.gov.uk/stellent/groups/dft_susttravel/documents/page/dft_susttravel_504129-31.hcsp						
transport energy					x		x		
	Best Practise: Fleet Management	Transport Energy	http://www.transportenergy.org.uk/bestpractice/fleetmanagement/						
green travel plans					x		x	x	x
	The Benefits of Green Transport Plans: the Guide	DETR 1999	http://www.dft.gov.uk/stellent/groups/dft_susttravel/documents/page/dft_susttravel_027685.hcsp						
	Developing an Effective Travel Plan: Advice for Government Departments	DETR, 2000	http://www.dft.gov.uk/stellent/groups/dft_localtrans/documents/downloadable/dft_localtrans_504096.pdf						
Noise									
during construction				x	x	x	x	x	x
	How much noise do you make? A guide to assessing and managing noise on construction sites (PR070)	A J Wills and D W Churcher, 1999	http://www.ciria.org/acatalog/PR070.html						
during use				x	x	x	x	x	x
	Acoustics Design Considerations (0113222343)	NHS Estates, 1996	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113222343						
	Acoustics Management Policy (0113222335)	NHS Estates, 1996	http://www.tso.co.uk/bookshop/bookstore.asp?FO=38383&Action=Book&ProductID=0113222335						
Nutrition									
food and health					x		x	x	
	Food and health action plan : food and health problem analysis for comment	DoH, 2003	http://www.doh.gov.uk/fahap/						
	Saving Lives: Our Healthier Nation	DOH, 1999	http://www.doh.gov.uk/ohn.htm						
	Food For Health	The Kings Fund, March 2003	http://194.66.253.160/pdf/food4healthsummary.pdf						
	Good Food on the Public Plate: A manual for sustainability in public sector food and catering		http://www.sustainweb.org/pub_recent.asp						
	Sustain: Response to the consultation document on a food and health problem analysis, leading to a food and health action plan.		http://www.sustainweb.org/pdf/15_09_03.pdf						
Housing									
staff key worker accommodation					x		x		
student accommodation		Whipps Cross Hospital	http://www.whippsx.co.uk/development.htm		x		x		
carers accommodation					x		x		
Economic Sustainability									
Employment									
employment policy & conditions					x		x	x	x
	Human resources and training in the NHS	Department of Health	http://www.dh.gov.uk/PolicyAndGuidance/HumanResourcesAndTraining/fs/en						
local employment					x		x	x	x
	Working for Health: The NHS as an employer and its role in regeneration	The Kings Fund, 2001	http://www.kingsfund.org.uk/						
	Employment Improves your Health	NHS London Regional office, 2002	http://www.doh.gov.uk/london/						
	Creating local jobs from construction expenditure	Joseph Rowntree Foundation	http://www.jrf.org.uk/knowledge/findings/housing/H140.asp						
Green purchasing									
green purchasing					x		x	x	
	NHS purchasing and Supply Agency (PASA)		http://www.pasa.doh.gov.uk/						
	Greening the Supply Chain	PASA	http://www.pasa.doh.gov.uk/suppliers/selling/supply_chain.stm						
	Green Guide for Buyers	DETR, 1999	http://www.sustainable-development.gov.uk/sdig/improving/partf/greenbuy/						

	The Green Guide to Materials Specification (comparative information on the environmental impacts of different materials)	BRE	http://www.brebookshop.com						
	The Mayor of Londons Green Procurment Code	GLA	http://www.londonremade.com/london_remade/download_files/GreenProcurementCode.pdf						
	Sustainable construction procurement. A guide to delivering environmentally responsible projects (C571)	Ciria	http://www.ciria.org/acatalog/C571.html						
	Environmental Issues in Purchasing (PPC(G)99/3)	Procurement Policy committee, HM Treasury and Department of the	http://www.hm-treasury.gov.uk/about/about_envpurchase.cfm						
sustainable sources				x		x		x	x
	Sustainable timber	Forest Stewardship Council	http://www.fsc-uk.info/						
	Sustainable timber	PASA	http://www.pasa.doh.gov.uk/sustainabledevelopment/environment/timber.stm						
buying locally					x		x	x	x
	London Food Links Hospital Food Project	London Food Link 2003	http://www.sustainweb.org/london_hospital.asp						
	Food Miles - Still on the Road to Ruin?		http://www.sustainweb.org/pub_foodtran.asp						
	The Food Miles Report: The Dangers of Long Distance Food		http://www.sustainweb.org/pub_foodtran.asp						
buying organic					x		x	x	
	The Organic Directory	Soil Association	http://www.soilassociation.org/web/sa/saweb.nsf/OtherDocs/NoAccessDirectory.html						
	Eating Oil: Food supply in a changing climate.		http://www.sustainweb.org/pub_recent.asp						
supply chain management					x		x	x	
	The handbook of supply chain management (C546)		http://www.ciria.org/acatalog/C546.html						

Footnotes

This Advisory Navigation Tool has been developed by Brook Lyndhurst Ltd and FaberMaunsell Ltd as part of a contract placed by the NHS and the Carbon Trust (2002-09-079-4-6)

This spreadsheet is accompanied by explanatory notes and a user guide, which includes details of update protocols.

BUILDING FOR HEALTH

EMBEDDING SUSTAINABILITY IN THE PFI PROCESS – GUIDANCE MODULES

The following section provides a detailed set of guidance modules which identify the key stages in PFI procurement and identifies the main intervention points at which sustainability can be embedded in the process.

The section is structured as follows:

- A short introduction and summary of the 5 modules;
- The five modules themselves, which identify in more detail what measures should be considered at each stage and provides checklists to assist project teams.

The modules refer specifically to energy as a way of giving a clear example as to how the various sustainability measures can be included.

These modules were developed through sponsorship of the Carbon Trust. The Carbon Trust is an independent company funded by Government. It's role is to help the UK move to a low carbon economy by helping business and the public sector reduce carbon emissions now and capture the commercial opportunities of low carbon technologies.

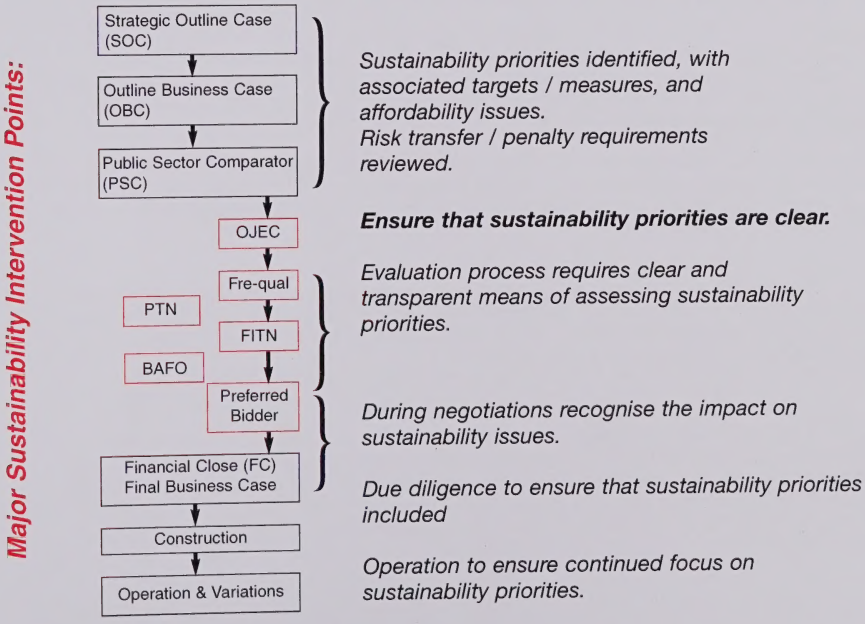
At the time of issuing this documentation, the Department of Health's Private Finance Unit is consulting upon a change to the way in which the payment mechanism and contractual provisions for energy work in PFI projects. This guidance should be read alongside the eventual position reached.

EMBEDDING SUSTAINABILITY IN THE PFI PROCESS

Because of the "whole life" nature of PFI projects, the PFI process offers a number of opportunities to embed sustainability in new and refurbished hospitals. Ideally ahead of the PFI process, individual NHS Trusts should already have identified their sustainability priorities and policies, in which case the PFI project becomes an instrument through which these priorities can be achieved.

- In essence ensuring "sustainability" is embedded in the PFI process requires that NHS Trusts:
- Identify what they want at the outset, whilst recognising affordability issues;
- Ensure that bid teams understand these priorities and how they are to be assessed against them;
- Make sure sustainability priorities are included in the contract against hard measures wherever possible.
- Are aware of the potential to lose sustainability priorities at each stage of the process;
- Monitor the construction and operation phases to ensure sustainability targets are being achieved.

In terms of the PFI process, there are a series of stages in the process where sustainability issues need to be incorporated, and where there is potential to "lose" sustainability objectives. Wherever possible sustainability objectives should be included as hard objectives or Key Performance Indicators (KPIs) – eg a specific energy consumption target. Ideally within the contract there should be penalties, and / or "shared pain / gain" schemes to ensure the ProjectCo focuses its efforts on meeting sustainability priorities. It should be recognised that phrases in the contract such as "best endeavours" offer the ProjectCo a "get out", and if there is no alternative, such areas may be best supported by requiring public reporting by the ProjectCo of how it has performed in these areas. The following illustration summarises the key intervention points:



Associated with the above view of the PFI process, a series of modules have been developed to provide more detailed guidance on how to include sustainability at each stage of the PFI process. The modules refer specifically to energy to give a hard example of how each sustainability issue can be included.

The following is a summary of these modules:

Module 1
Module 1 concerns development of overall sustainability objectives, targets, and measures at the Strategic Outline Case (SOC), Outline Business Case (OBC), and Public Sector Comparator (PSC). . It is at this stage that realistic sustainability requirements need to be established for the required design features and affordability issues need to be considered at the OBC and PSC stages. Ideally sustainability issues should be identified by the Trust ahead of the project.

Interventions comprise a review of draft OBC and PSC to ensure that:
Sustainability issues are included
Key performance indicators have been identified to assess bids / provide information to bid teams
Where practicable the importance of including risk transfer, shared "pain / gain" schemes, and penalty clauses are recognised.

Module 2
Following on from module 1, module 2 concerns the information that is provided for the bidders, on which to base their designs. The main feature in this stage is the Output Specification with, where appropriate (eg energy use) the associated Payment Mechanism. The sustainability priorities and any risk transfer mechanism required must be explicit.

Documentation should be reviewed for sustainability content at first final, and final, draft stage although advice will be available before this stage.

Module 3
Module 3 covers the bid evaluation process and final negotiations up to Financial Close. It is important that compliance with the sustainability requirements is not overlooked in the evaluation and selection process. The requirements for sustainability objectives and any transfer of risk must be maintained in the process leading up to, and including, Financial Close and not "negotiated out".

Intervention in this stage takes the form of ensuring that the sustainability content of the bid is fully evaluated against the sustainability KPIs, and that bids are not accepted if this area is omitted or the detail is insufficient. During "preferred bidder" negotiations there may be sweeping changes to design, and the sustainability aspects of these changes need to be evaluated.

Module 4
Module 4 relates to the construction period. It refers to the need to be sure that sustainability issues during construction are complied with, and sustainability features properly included. This will require some degree of inspection and review. Any changes in the specification should be checked to ensure that sustainability issues are being considered.
Ideally the "due diligence" review of the building should include sustainability issues.

Module 5
Module 5 covers the operational stage of the building. Clearly the building has to be operated in a way that supports the sustainability features associated with its design and proposed operation. Key sustainability issues should be monitored and reported. Adjustments to the contract should consider sustainability issues. One of the main features here is ensuring that full details of the "sustainability" strategy for the facility are available and all facilities management and users receive use and awareness training.

PFI / PPP Procurement Support Pilot Programme

CARBON TRUST

Making business sense of climate change

Module 1: "Making the Case", Hospitals

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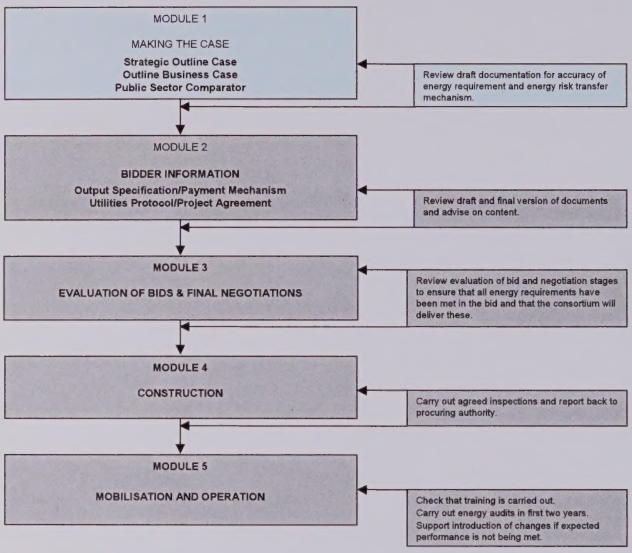

1. Introduction

This module is aimed at assisting Trusts in making the case for developing, constructing and operating a new development. It is at this stage broad sustainability priorities and targets need to be established, and the cost and other implications associated with their implementation understood by the Trust. It is also important that the Trust understands that specific priorities will only be successful if they are asked for throughout the PFI process. As such this module should be read in conjunction with the other module documents in this series that cover the PFI process. At the end of this document a checklist for advisors/Trusts is provided to ensure that the energy and sustainability issues highlighted in this module have been considered.

Sustainability issues include economic, social and environmental issues such as waste, water, regeneration and use of resources, energy itself is a sustainability issue and is a main focus of these modules. Acting in a more sustainable manner, often has indirect energy benefits, eg lower water use, reduced use of materials during construction through the avoidance of waste, and recycling can reduce energy consumption for the Trust or elsewhere in the supply chain.

2. Strategic Outline Case

The Strategic Outline Case (SOC) or any such document such as Initial Expression of Interest is the mechanism by which the Trust provides the necessary information to the relevant Governement Department. If granted approval at the Department level, the document is submitted to a departmental Project Review Group (PRG) these are the first steps in the PFI process.

The Strategic Outline Case guidance highlights a number of areas associated with why a new hospital is required including:

- Strategic context
- Service need
- Formulation of options
- Affordability
- Timetable and deliverability

  - Strategic Context – the Trust should set out their aspirations for health service provision and demonstrate how the proposed scheme is consistent with these requirements. The Trust will have liaised with key contacts and stakeholders of other similar building types to identify the need for additional or replacement of existing services.
  - The service need for the proposed scheme should be demonstrated by detailing the service problems which the scheme is intended to address. E.g. insufficient availability of service provision, ageing and inefficient facilities.
  - Formulation of Options – a shortlist of options which satisfy service need, are within the strategic context and which are affordable should be developed. Preferred options should be highlighted. The 'do-nothing' option is analysed as a base case.
  - Affordability – The Trust is to set a ceiling cost for the bidder to work to which has been accepted by the Trust. This is a key element as individual Trust's often under-estimate the costs of the project, which means that at Financial Close, or before, the Trust can be faced with a choice as to where it has to cut costs. The Trust should be encouraged to make realistic assumptions about costs, and prioritise requirements at an early stage.
  - Timetable and Deliverability - A proposed project timescale including key milestones should be developed. The Trust should detail the desired project delivery outcome, including timescales, milestones and project duration.

There is a wide range of sustainability guidance available to Trusts, and at this level it is probably sufficient that the Trust identifies the key sustainability issues and drivers (eg requirement for a NEAT assessment), and aspirational objectives. Trusts will normally have selected their client advisors by this stage. In practice it is important that client advisors have an understanding of energy issues, or at least the capability to provide the necessary level of support (eg through the use of various computational models). It is also necessary that the "energy advisor" is able to work with the client advisor team.

It is appropriate that the Trust's own sustainability priorities are put into the context of others that will directly impact on the Trust's own priorities. The most relevant are:

- The Department of Health's (DH) own targets and objectives (eg 15% cut in carbon emissions target, energy target of 35-55GJ/100m^3 for new build). Guidance on "Sustainable Development in the NHS" is available from the DH website at: http://www.nhsestates.gov.uk/download/publications_guidance/SusDev.pdf.

- The Local Authority's own sustainable development priorities, eg see their supplementary planning guidance on sustainable development which is usually available on their web site.
- The Strategic Health Authority's (SHA's) own priorities, and in particular it is worth learning from the experiences of neighbouring Trusts within the SHA. It is important that the Trust uses the various formal and informal networks to identify what has worked and what has not, and to understand what various bid teams have accepted as part of other Trust's PFI projects.

One of the energy advisor's main objectives is to help the Trust through the mass of guidance and targets that they face. Although the objective at this stage is on broad sustainability priorities, throughout the advice cycle advisors should focus in particular on energy issues.

There are a number of ways of identifying sustainability priorities. One mechanism is to encourage some form of "sustainability" workshop amongst the key players within the Trust at an early stage so that the implications of their early expectations can be understood, and the recognition that there are sometimes trade offs between different sustainability issues. Clearly "fitness for purpose" frames the context in which sustainability and energy has to be considered.

The main points of the Strategic Outline Case should be summarised and made available to bidders as this will enable bidders to develop an understanding of the strategic context of the project and how it meets the requirements of the local area and local Improvement Plans. Any national initiatives should also be outlined.

Energy and sustainability issues need to be considered by the Trust early on in the project process in order that both the Trust and bidder are aware of the requirements. The sustainable development agenda is very broad and individual Trusts need to identify their key sustainability issues, and importantly understand the consequences of their sustainability, and environmental priorities. For example cladding the building in photo-voltaics is unlikely to be cost effective. A very tight environmental specification (eg 23C+/-2C) has significant energy implications.

Whilst energy consumption is important to a Trust (energy bills of £1M are typical for the larger Trusts) it is not always a key decision making issue. However the Trust should recognise that failure to consider energy at every stage of the PFI process will mean that a successful outcome is less likely, and as a result future energy bills are likely to rise. This is a key role of the energy advisor.

As such it is important that the Trust recognises its energy and sustainability priorities at an early stage, and in particular understands the whole life implications of pursuing a particular set of energy and sustainability issues at an early stage.

Aside from the need for a new hospital facility there are a number of key drivers, opportunities and risks to consider with regards to energy and sustainability. Risks include likely increases in energy costs during the life of the project, and possible availability issues; and the trends towards increased legislation, and tighter regulations, to minimise environmental impacts; and the likely impact of climate change on the operation of the hospital (eg impact of warmer summers). The Government also operates a number of support schemes to support eg "Clear Skies". The drivers listed below highlight where possible costs may be incurred during future operation and where cost savings could be made.

Module 1: "Making the Case", Hospitals

Business Drivers with Financial Impact	Impact	Potential Improvement/ Mitigation
The Climate Change Levy (CCL) www.defra.gov.uk/environment/ccl/	Currently has increased the cost of utilities	Possible further mitigation through purchase of renewable electricity.
The Climate Change Levy (CCL) – Exemption	Consideration of new equipment e.g. Use of CHP plant (Combined Heat & Power)	Possible further mitigation through purchase exempt "Good Quality" CHP plant. Opportunity to select plant that is inherently more energy efficient.
Energy cost savings	Reduction in energy costs – see Action Energy below	Implementation of a Energy or Carbon Action plan. Focus on whole life costs.
EU Emissions Trading Scheme (EU ETS) – Direct impacts http://www.defra.gov.uk/environment/climatechange/trading/eu/	Compliance cost of emissions above reduction target uncertain at present, but may affect large CHP schemes.	Awareness of UK emission requirements. Introduce internal abatement measures.
EU Emissions Trading Scheme (EU ETS) – Indirect impacts	Increase in electricity cost, potential 16-40% increase over next five years.	Design in energy efficiency options – factor future price rises into energy efficiency measures payback calculations.
Renewables Obligation	Potential indirect cost	Impact of the Renewables Obligation is included in the supply contracts.
Enhanced Capital Allowances http://www.eca.gov.uk/etl/homepage.asp	Adoption of ECAs for capital investment	Continue claiming for all products on the technology list.
Energy Efficiency Commitments	NHS/DFES own policy drivers and targets (eg 35-55 GJ / 100m^3)	Must be considered.
Building Regulations Part L	Likely increased capital cost due to more stringent energy performance standards	Ensure compliance
Health Technical Memoranda	Set eg ventilation and service requirements, may have implications on energy use and on the selection of services	Review of the HTMs with DoH and NHS Estates on a case-by-case basis.
EU Energy in Buildings Directive	Likely increased cost due to more stringent energy performance standards, and	"Public" buildings – will need to make the information publicly available.

Business Drivers with Financial Impact	Impact	Potential Improvement/ Mitigation
	requirements for monitoring and reporting of energy use.	
NHS Estates – Guidance document www.nhsestates.gov.uk	Requires the energy consumption figure to be between 35-55 GJ/100m^3	Care needs to be taken in ensuring a sensible target is used that ensures that the design is "fit for purpose". There is substantial potential for adjusting the target by adjusting design and operational parameters, and the Trust needs to be aware of the "games" that bid teams can play in meeting a particular target.

Trusts and ProjectCo can use opportunities such as the Enhanced Capital Allowances Scheme to reduce the cost of energy saving technologies. Specification that new plant must, where possible, be selected from the ECA Technologies should mean that the hospital is inherently more energy efficient (http://www.eca.gov.uk/etl/homepage.asp). There may also be financial benefits to the ProjectCo of using such technologies.

3. Outline Business Case

The Outline Business Case (OBC) is an opportunity for a description of the planned facility to be developed with some suggested options and requirements the Trust has about the design. The OBC sets out whole life cost estimates (including an allowance for risk), capital cost and capital charge equivalent estimates for the project. Accurate costs must be included in the OBC and PSC.

In developing the business case the following must be considered:

- Specific Energy Targets

  Hospitals target set as 35-55 GJ/100m^3 for new build by NHS Estates guidance, the actual figure will also depend on the type of facility and how it is used.

- Comfort conditions under given external climate and internal gains stipulated, and the implications of these targets in terms of patient care, staff working environment, and costs needs to be recognised.
- Robustness / flexibility issues recognised.
- Generic approach associated with energy consumption recognised – e.g. daylighting, natural ventilation. Trusts should refer to Health Technical Memorandums etc.
- Needs for compliance testing during construction / commissioning identified and included as part of the bid requirements
- Ensure Trust advisors or internal estates team have sufficient energy experience in areas of (a) contract setting; (b) benchmark setting and later adjustment; (c) overall

energy efficiency approaches and impact on other hospital operational issues; (d) understanding of general energy efficiency issues such as cost effectiveness.

- Statement of assumptions used, this is to demonstrate how any changes would affect the ranking of options, including any changes to the assessed benefits of the scheme. E.g. occupancy hours, occupancy levels, new equipment, change in use

Guidance on how energy efficiency can be incorporated into the project through the design, construction and operation is provided at the end of the document. This information is categorised by building type and headline indicator issue. Energy and other sustainability issues are included.

The business case should also detail the assessment criteria to be used in assessing the bids – consideration of energy and sustainability should be included.

PFI fixed cost rate time scale for the provision of services, (anticipated end of service time period for equipment).

Deliverability of the project should be demonstrated at the business case stage to ensure that bidders are made fully aware of the extent of this project. Timescales of the negotiation, construction and operation phases should be clearly stated.

4. Public Sector Comparator

The Public Sector Comparator (PSC) is the method of comparing the PFI procurement process with traditional procurement. This is done, using guidance contained in the Green Book, to obtain realistic, whole life costs for each option. There is clearly a significance, therefore, in ensuring that all cost inputs, including energy, are correctly identified for each option at business case stage, as it will influence whether or not the PFI solution represents value for money.

The Treasury have announced their intention to replace the PSC with value for money guidance. At present the PSC is important to the PFI process as it effectively sets affordability limits on the costs of new hospitals.

Since the PSC will in essence set a limit on the likely maximum expenditure available to the Trust, ideally the PSC calculations should reflect not just the size of the hospital, and particular function, but whole life considerations on issues such as energy consumption.

Since the public sector comparator is a hypothetical risk adjusted costing exercise, based on previous experience, and major cost elements based on clinical provision it is unlikely to include costs of energy efficiency and sustainability. Ideally assumptions about future energy costs included in the PSC should include an allowance for the likely future increase in energy prices (eg 16-40% increase anticipated over the next five years). The dilemma here is that there is no officially recognised future cost scenario, or mechanism to include energy in the PSC, so the question is what energy prices should be used. One solution would be to use a sensitivity analysis to look at the impact of different future energy price forecasts (eg use energy fixed at current prices; increasing at 2%/annum in real terms; etc).

The Treasury has announced that it intends to replace the PSC with "value for money" guidance. However it should be recognised that "affordability" will always be an issue that will limit costs / the unitary charge.

In order to develop a comprehensive public sector comparator the following issues must be included.

- Capital costs (investment)
- Lifecycle costs, including
  - Energy, maintenance, replacement costs
  - Operating income
- Risk adjustment
- Mobilisation costs

Where refurbishments are undertaken or extensions to existing buildings to a level where Part L2 of the Building Regulations apply, then the PSC calculation must take account of the improvements to the existing building.

Where changes are made to the Outline Strategic Case and Business Case, the PSC must be recalculated to take account of these alterations to the design.

5. OJEU

OJEU notices are the means by which potential ProjectCo are notified of new projects, this information is posted on the OJEU website http://www.ojeu.com. Currently, the energy issue is included in the OJEU call for tenders announcements in a very indistinct way. Reference to energy is only usually made in the more detailed information received after the ProjectCo bid team's expression of interest. As part of the project description on the OJEU notice it should be made clear that energy use is a key consideration. It could also be included in the award criteria section.

Information that should be considered as part of the OJEU includes:

- Requirement for energy volume risk to be shared between Trust and identified ProjectCo teams. The DH Private Finance Unit (PFU) team can provide some assistance on how best to achieve this, and their requirements on the payment mechanism (currently being reviewed) must be followed.
- Requirements for energy targets to be met, with suitable penalty clauses for failure of the "as built" building to meet these targets.
- Innovative solutions from ProjectCo bid teams to energy consumption identified, and they should be asked to demonstrate how the whole life costs of the project have been considered and minimised..
- Included as one of the objectives to be scored.
- ProjectCo bid teams to be required to demonstrate ability to deliver energy efficiency (eg through past exemplars)
- Reporting requirements identified
- Compliance with building regulations and NHS Estates guidance seen as a minimum requirement only.
- Welcome suggestions from ProjectCo bid teams as to how energy efficiency requirements can be exceeded.

- Welcome suggestions from the ProjectCo bid teams specifically on how they might operate a "shared savings" approach to later investment in energy efficiency measures during the life of the hospital.

6. Information Sources

A wide range of information is available on sustainability. No list of relevant web sites is ever either exhaustive or up to date. The following has been produced to signpost some of the more relevant sites.

Examples of Guidance and Case Study Documents

PFI and Sustainability
o Green Public Private Partnerships - A guidance note on how to include environmental considerations within PPPs and PFI projects; ODPM, 2002 http://pfi.ogc.gov.uk/Download.asp?id=711&field=5&filename=Green+Guidance%2Epdf
o Sustainability lessons from private finance and similar private initiatives BRE 2002, http://www.brebookshop.com/details.jsp?id=140225
o Sustainable PFI - Contracts and Incentives CIEF, 2003 http://www.ciria.org/cief_events_notes.htm

Environmental Energy & Emissions
o NHS Environmental Assessment Tool (NEAT) http://www.nhsestates.gov.uk/sustainable_development/index.asp?submenu_ID=neat
o NHS Estates - Low Energy Hospitals NHS Estates http://www.tso.co.uk/bookshop/bookstore.asp?action=searchresults
o The Utilisation of Energy in Hospitals Faber Maunsell, 2004 Contact FaberMaunsell for details 020 8784 5784
o Sustainable Development:Energy NHS Estates http://www.nhsestates.gov.uk/sustainable_development/content/energy.html
o Energy consumption in public and commercial buildings, BRE http://www.brebookshop.com/details.jsp?id=1129
o Achieving Energy Efficiency in New Hospitals (0113223390) NHS Estates, 1994
o Carbon Trust Website www.thecarbontrust.co.uk/energy (wide range of technology and sector specific documents available on-line) o Low Energy Hospitals: Wansbeck General Hospital, Ashington, Northumberland: 1st year appraisal (0113223447) NHS Estates, 1995
o Low Energy Hospitals- St Mary's Hospital, Isle of Wight (1st and 2nd year appraisals and final report) NHS Estates, 1999 http://www.tso.co.uk/bookshop/bookstore.asp

7. "Making the Case" Checklist

The checklist provided on the following pages lists the issues that should be considered –and where applicable implemented – whilst "Making the Case" for the development in the early stage of the PFI process. This stage of the process is key for the Trust to develop the project aspirations and set the framework for energy and other sustainability issues to be considered throughout the PFI process.

Module 1: "Making the Case", Hospitals

	Check	Requirement	Output	Required Action	Requirement Met?
1	Does the strategic & business context define the project aspirations from a sustainability / energy perspective?	Energy efficiency and other sustainability issues have been considered and prioritised in the context of wider Trust objectives at the start of the process. Trust understands what needs actions are needed at each stage of the PFI process such that energy efficiency is successfully included and maintained.	▪ Energy and sustainability priorities identified. ▪ Energy, Carbon and broader sustainability indicators included in project objectives. ▪ Recognition that energy and sustainability objectives need to be included at each stage of the PFI process. ▪ Route map that reflects how sustainability / energy priorities will be included in the PFI process ▪ Agree that a whole life approach should be followed at all stages of the PFI process in terms of the selection of specific energy efficiency measures (so that such measures are not lost at later stages of the PFI process). ▪ Recognise the importance of networking / external benchmarks in developing realistic goals and objectives – make use of other Trusts' experiences.		
2	Have specific sustainability/energy aspirations of the project been clearly identified?	Review of energy requirements and broader sustainability issues has been made with the Trust. Priorities identified. Any specific features required identified for included in specification.	▪ Key issues identified and incorporated into the strategic and outline business cases where appropriate. ▪ Full consideration of "business drivers" identified in module used to influence Trust. ▪ Specific examples of changes in strategic / business cases identified.		
4.	Early consideration on building form, internal conditions, orientation considered.	▪ Trust aware of the impact of early design decisions on energy use and other sustainability issues, and instructs advisor team to take account of these issues.	▪ Site specific issues considered, and included in PSC. ▪ Specific requirements included in the output specification, other preferences identified to be passed to the bid teams in later work.		
5.	Procurement timetable and process	▪ Detailed requirement for considering energy /sustainability in the context	▪ Explicit "process" timetable and route map.		

Module 1: "Making the Case", Hospitals

	Check	Requirement	Output	Required Action	Requirement Met?
		of a timetable for tender submissions, bid evaluations, ITN and contract award has been set.			
6.	Requirements for energy to go in output specification	▪ Penalty clauses / remedial work if actual energy use in bedding in period exceeds design targets. ▪ Shared pain / gain volume risk scheme ▪ Framework for future investment in energy efficiency measures	▪ Trust agrees need for output specification to include features.		
7.	Robustness of design	▪ Robustness of design considered as an important assessment issue – eg how well the building responds environmentally, energy use, and in cost terms to change in use, climate change etc ▪ Impact of future energy price changes – include in PSC	▪ Trust understands issues / trade offs ▪ Agreement to frame bidder information to reflect priorities. ▪ Agreed approach to considering future energy price changes in terms of whole life costs (no formally agreed procedure is yet in place)		
8.	Assessment criteria for energy / sustainability issues	▪ Ensure bid assessment criteria will include energy / sustainability issues.	▪ Discussion over how this can be achieved – weightings etc. ▪ Agree to move key issues into output specification as a requirement, rather than an option.		

Glossary

CCL – Climate Change Levy
DfES – Department for Education and Skills
DH – Department of Health
ECA – Enhanced Capital Allowances
HTM – Health Technical Memorandum
NHS – National Health Service
OBC – Outline Business Case
OJEU – Official Journal of the European Union
PSC – Public Sector Comparator
SHA – Strategic Health Authority

PFI / PPP Procurement Support Pilot Programme

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Module 2: Bidder Information, Hospitals

May 2004

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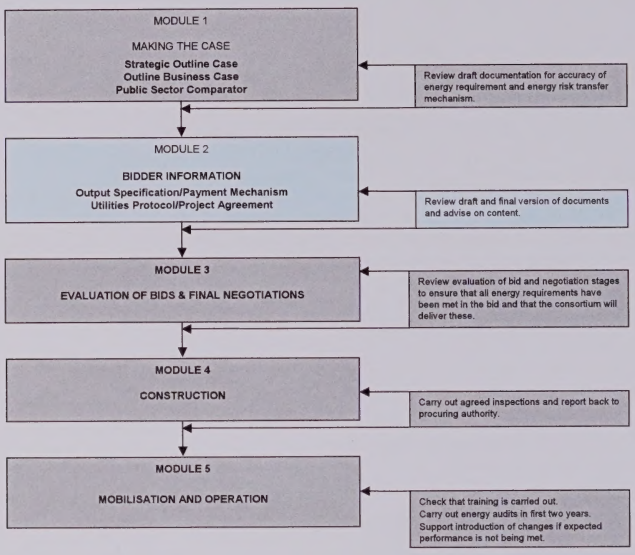

1. Introduction

The PFI Advisor Support Scoping Study recommended the examination of the provision of tailored energy efficiency advice to ensure good energy efficiency standards are built into:

- The Output Specification
- Payment and risk sharing mechanisms
- Bedding in periods and Utilities Protocols (if adopted).

In addition the above documentation must reflect the assumptions for cost and risk built into the Public Sector Comparator or the benefits of the first intervention for energy efficiency and carbon saving will be lost.

The information provided to the bidder is an important point at which the energy requirements for the project are first encountered and there must be a clear statement of what is required.

Initial documentation contained within the Invitation to Negotiate that contains reference to the energy efficiency requirements is in the Output Specification, with additional risk information contained in the Payment Mechanism. The Payment Mechanism should always be developed thought this has found not always to be the case.

The key requirements that should be included in the output specification are:

- A specific energy design target is set that reflects clinical need, site issues, etc, and meets DH guidelines. Bid teams are encouraged to do better than this target.
- Remedial work, or penalty clauses, are introduced if actual energy use in the second year of operation exceeds design targets.

- Energy volume risk is shared between the ProjectCo and Trust as part of a shared pain / gain scheme.
- Clear mechanisms are in place to ensure on-going investment in energy efficiency measures eg due to advances in technology or changes in energy prices at some stage during the life of the project.
- The contract is written so as to encourage good energy management (eg reporting, metering, Trust staff training on the operation of the building), given the respective roles of the Trust and the ProjectCo. In practice this will involve close working between the two parties.
- Responsibilities on the part of the procurer during the operation of the building, also need to be identified. Energy consumption will be dependent on the activities of hospital staff and the Trust as well as the ProjectCo.

2. The Output Specification

The Output Specification (OS) and associated documentation is the most powerful tool for ensuring the requirements of the procurer are met. It is often developed by a Procuring Authority individual or team who typically will only be involved in one project. The following gives guidance on content requirements if energy savings and risk transfer are to be achieved.

2.1 The Output Specification defines what the procurer wants to achieve

- Avoid omissions, lack of good practice and loss of confidence in the energy efficiency requirements
- The Output Specification should detail what needs to be achieved, not how it is to be achieved
- Allow the bidders to develop original solutions to match the requirements.

2.2 The Output Specification must be explicit about energy efficiency and risk transfer.

- The Output Specification must be definitive and unequivocal about energy efficiency and make it clear that this will be examined in detail in the bid evaluation process.
- Remove any concerns bidders have that by putting forward a compliant low energy design they may make their bid less competitive because not all bidders have included this requirement.
- Make it clear that any bids that do not meet the bid evaluation requirements for energy will be returned.

2.3 The design requirements should be flexible and allow a robust solution for energy efficiency

There is a balance to be struck between specifically requiring specific energy efficiency measures, and allowing the bid teams to provide their own solutions given overall energy targets. Over specification in the design requirements may force a solution that makes achieving energy efficiency more difficult.

There are some key issues that will affect predicted energy consumption in hospitals are:

- Building form is important – a deep plan building is likely to have higher energy consumption than narrow plan construction. The need for clinical adjacencies, planned future space flexibility, and site specific issues will all need to be considered.
- Close restrictions on temperatures, ventilation, humidity, lighting levels, etc will increase energy consumption. Whereas tight control of conditions may be required in some areas, it will be less important elsewhere.
- Patient / equipment densities are important in determining the levels of internal gains, and hence of air-conditioning requirements. The less the space for patients and equipment, the more highly services the building has to be, and the higher the energy use.

- The use of cooling in, for example ward areas, will increase energy consumption. The underlying issue is whether additional costs and environmental impacts associated with the use of cooling will be justified by possible improvements in patient care / staff productivity. In the particular case of ward areas avoiding cooling is likely to lead to capital, as well as running, cost savings, but there are differing views as to whether cooling is necessary in ward areas. Natural ventilation during hot summers, will lead to elevated ward temperatures. Climate change means that we are likely to have longer, hotter, summers on average. There are patient care and staff productivity issues associated with such conditions. Also in some recent PFI projects, some naturally ventilated areas have been retrofitted with cassette air conditioners to meet staff needs – and this approach will increase capital and running costs.

2.4 Energy targets must be realistic and progress towards them must be measured at each stage. If actual energy exceeds design values, remedial work, or penalty clauses should come into effect.

- Energy targets that are put forward may be challenging but must be realistically attainable.
- Guidance and absolute limits are given in a variety of official documentation, with the DH requiring new build hospitals to have a predicted energy consumption between 35-55GJ/100m^3.
- Some targets have lost credibility because they can be deemed to be unattainable (particularly when they include end uses that are related to non building environment use) for a particular specification.
- Within the DH requirements for energy, ideally targets need to be developed which are relevant to the project (see also under Payment Mechanism).
- Establish a process that will enable design and construction to be tested for suitability with clinical need, etc.
- Deficiencies at the design and construction stages must be connected to financial penalties and bonus mechanisms which impact on the designer and constructor rather than the operator. This connection must be set out in the Output Specification.
- To ensure progress towards targets can be monitored easily, the modelling or calculation method, to be used with all underlying assumptions and defaults must be specified or agreed.

If the target energy consumption (or proxy target – eg air tightness) agreed with the successful bid team is exceeded during the second year of operation (first year involves extensive "bedding in") the ProjectCo should undertake remedial work, or an appropriate penalty. There are different approaches to this issue.

Specific measures (eg air tightness) can be included in performance testing, with the ProjectCo required to reach a particular target – which relates to energy consumption. The comparison of design v actual energy use is open to evasion as there are legitimate reasons why the ProjectCo may not be responsible for excessive energy use (- eg the level of internal gains, or increased occupancy hours). As such the mechanism for comparing actual and design energy use becomes important.

There is also a need for balance with this particular issue – ProjectCos will cost risk in their bids, and if they see a very high, and uncontrollable risk, to themselves, the unitary charge will be significantly affected.

2.5 Energy (volume) risk that is being transferred must be identified.

There are a number of shared gain / pain schemes operating within PFI, and ProjectCos have become more willing to accept some volume risk as they have become more aware of the actual risks involved. However there are some areas associated with shared savings schemes (see payment mechanism) where there is room for negotiations on the exact form of the shared pain / gain scheme. Some of these issues include:

The relative degree of responsibility of the Trust / ProjectCo on energy use. 50/50 pain / gain share agreements are the norm, with a more sophisticated approach being to vary the risk share depending on the relative importance of the Trust / ProjectCo on the area of end use. For example:

- The environmental requirements for energy of the design (heating, cooling, mechanical ventilation and lighting) can be benchmarked and predicted relevant to the design with some accuracy, while variations in small power uses can not.
- A bidder may more readily accept challenging environmental energy targets and risk, which can be controlled, if uncontrolled small power use by occupants is the responsibility of the procuring authority.
- The Output Specification should only require small power use risk to be transferred if a detailed energy management system and a utilities protocol are specified.
- Some uses, e.g. process and clinical use, are rarely in the control of the ProjectCo.

One of the key issues here is that too overly sophisticated a pain / gain scheme will entail a cost associated with its implementation.

It is also important for the Procurer to recognise that they share responsibilities over energy management issues – it isn't just a case of the Procurer passing all responsibility to the ProjectCo, and the Procurer should identify their willingness to work with the ProjectCo in this area.

2.6 Energy (volume) risk transfer requirements in the Output Specification must be sustained.

- The FM operator may attempt to reduce the risk arising from design and construction deficiencies by using a "bedding in" period to set operational targets. This can be tackled by requiring warranties that actual consumption will meet design use (see earlier).
- The FM operator may also reduce risk if there is not stringent monitoring of performance during a "bedding in" period to prevent manipulation of the consumption levels.
- "Bedding in" can be turned to the procurer's advantage by making this period the final test of the design and construction, connecting the requirement to design and build to the energy design target to a financial penalty or bonus.

2.7 Allow for risk sharing and agreed target resetting.

- Bidders will be wary of an Output Specification and payment specification that only offers penalties and will make contingencies for this rather than being incentivised to make savings.
- A system of shared risk and reward (pain / gain agreement) and systematic target re-setting is generally seen as an acceptable way of containing energy consumption during the life of a contract.
- Sharing risk and reward allows the operator to receive some benefit from savings made by reducing energy consumption while sharing the risk.
- An agreed recalculation or benchmarking process for resetting targets when energy consumption patterns for the project alter (e.g. changed occupancy) must be clearly identified in the documentation.

2.8 Allow for technology improvements.

An opportunity to install advanced technology that will have an impact on reducing Carbon emissions may occur during the concessionary period. The output specification must clearly identify that this opportunity can be taken up by the ProjectCo or authority and include the procedure, which can be a risk/reward sharing enterprise. There are two generic approaches to this:

- The Trust / ProjectCo agree some form of additional renumeration if the ProjectCo undertakes a particular investment. This can be linked to a payment mechanism that links actually monitored savings against payments to the ProjectCo.
- The Trust decides that the ProjectCo cannot provide good value for money, and within the PFI agreement there are standard approaches to allow the ProjectCo to make their own additional investments.

The issue here is that in both instances significant resources may need to be expended to bring about either option. The more clearly the mechanism that the Trust / ProjectCo agree at the outset to agree how additional investment may be undertaken at the outset, the better.

2.9 Define Operational Requirements

To ensure that benchmarks and bids are realistic, key information must be made available.

Occupancy details are important for adjusting energy consumption benchmarks:

- hours of use (including core hours and opening hours)
- number of occupants (small power use, heating and cooling)
- activities (low, normal, high levels of physical activity)

It is also important to agree how these and other factors will be used in normalising actual energy use when comparing it against target values.

Minimum Environmental standards are important for defining energy loads:

- Acoustics (can impact on eg ventilation)
- Lighting
- Heating (maintained temperatures)
- Ventilation (Natural or Mechanical)
- Cooling
- Humidification

Room data sheets or information on environmental requirements will normally be provided by the Trust's advisors:

- In the case of a specification where bidders are asked to propose a design solution including number of rooms then generic room data sheets need to be provided.
- If a detailed specification is provided then individual room data sheets must be made available.
- If data sheets are provided at a late stage in the process this could be used as an excuse to renegotiate volumes or request "bedding in" for eventual benchmarks.

2.10 Define Facilities Management Requirements

- Identify the need for good practice in energy conservation and energy management to contribute to carbon reduction.
- Define the shared responsibilities for good practices between facility users and facility managers so that an allowance for each responsibility can be made in risk transfer agreements.

2.11 Utilities Protocol

A Utilities Protocol may be specified which allows the bidder to elaborate on how they will supply an energy efficient service which seeks continual improvement. Terms of reference will need to be provided to allow for evaluation, these should avoid unenforceable or impractical ideas

2.12 Encourage the use of renewable and low carbon technology

- The use of renewable and low carbon technology should be encouraged where it does not affect affordability, as although it will not contribute to the GJ/100m^3 target, it will reduce carbon emissions overall – and so contribute to the NHS carbon emissions reduction target. Although some renewables, such as photovoltaics (PV), are currently uneconomic, they may become economic at some point during the life of the project. As such a design that allows the easy retrofit of PV, and a payment mechanism that allows for a shared pain / gain scheme that will allow for the installation of renewables during the life of the project, would be sensible.

- Depending on the site, it may be possible to identify a fixed percentage of energy consumption coming from local renewable sources as a variable bid, or consideration of the feasibility of CHP (Combined Heat & Power).
- Bidders should be clear that their bids will be judged on their responses in this area.

3. The Payment Mechanism

The Payment Mechanism establishes the payments to be made for services provided, in the case of energy it usually identifies the volume consumption of energy that will be paid for in each payment (based on agreed unit rates) and establishes the risk or reward involved in consuming over or under the set volume. Part of the requirement from ProjectCo is a report of actual consumption over an agreed period.

3.1 The Payment Mechanism must identify utilities payments, risk and shared risk clearly.

The Payment Mechanism is an important part of ensuring that energy efficiency aspirations and risk transfer obligations are understood and met.

- The ProjectCo must be incentivised to meet energy efficiency targets by a risk reward mechanism that is easy to understand and feel secure that changes in use of the facility will be recognised and taken account of.
- The Payment Mechanism must be consistent in transferring the risk identified in the output specification. Fixed charges, such as standing charges, CCL etc. should be excluded from the risk transfer part of the mechanism.

3.2 Setting and revising consumption targets/caps

- Energy efficiency aspirations included in the Output Specification can be lost if the operator is allowed to amend targets from design targets to benchmarks based on actual running in a "bedding in period".
- Clear provision must also be made for reviewing targets on the basis of experience and changing circumstances at agreed anniversary dates. Trust should be alert to the possibility that the first year figures will include a significant contingency.
- If new targets cannot be agreed the dispute procedure must be invoked, this may involve an independent consultant.
- The ProjectCo must abide by the volume targets between review periods.

3.3 Managing "bedding in" periods

There may be occasions where a "bedding in period" is unavoidable, e.g. where there is a sizeable amount of newly commissioned plant. This period must be carefully managed by the Authority to ensure that target reviews are not distorted by inefficient use in this period. This can by achieved by regular monitoring and feedback to benchmark reviews.

The monitoring methodology is described in more detail in Module 5

4. The Project Agreement

Maintain energy efficiency aspirations from output specification

Energy efficiency aspirations may have been high on the agenda of those who contributed to the Public Sector Comparator and the Output Specification, but by the time of Preferred Bidder and price negotiations these people may have lost influence to financial advisors, the demands of affordability and risk avoidance.

- Maintain focus on the savings to be made on energy costs over the lifetime of the project.
- Resist efforts to relegate energy savings as being less important than other affordability issues.
- An agreed energy modelling process enables the effects of design changes on energy efficiency to be evaluated and helps to keep the agreed targets in view.

5. Specific Measures for Hospital Projects

Hospitals are given a relaxation on the Approved Document Part L2 of the Building Regulations and required to demonstrate compliance with Approved Document Part L of the Building Regulations 1995 for environmental design and energy consumption. At the time of publishing the new Approved Document Part L2 of the Building Regulations there was no update to the NHS Estates Guidance 1994 publication "Achieving energy efficiency in new hospitals" on which energy use in hospitals is considered. This is currently being reviewed and NHS Estates expect to produce new guidance in compliance with current Building Regulations in summer 2004.

To mitigate this inconsistency as far as possible the Minister of State for Health, indicated in April 2001 that new hospitals should achieve energy performance no worse than 35-55 GJ per 100m³.

Further information is available from http://www.nhsestates.gov.uk/sustainable_development

Health Technical Memorandums and Health Building Notes provide specific design and operational guidance on the requirements for different aspects of health facilities. Energy advisors must be aware of the requirements of these documents.

Since this document is intended to support the procurement process, the following set of measures first identifies if the requirements for energy savings detailed in the Output Specification are met.

5.1 The Output Specification defines what the procurer wants to achieve.

Energy references to existing buildings should identify where improved energy efficiency is required. Ideally, improvements in energy efficiency of existing buildings on refurbishment will be agreed, compliance with Part L2 of the building regulations will also be a guide. (refer to note above on Part L2 compliance)

It is recommended that references to environmental measurement methods, which include energy, should not be made here. This avoids the energy requirement being lost in environmental and sustainability issues.

There is now a requirement to assess the environmental performance of each NHS trust and this is achieved using the NHS Environmental Assessment Tool (NEAT) developed as a joint funded project by NHS Estates and DTI based on BREEAM methodology by BRE.

NEAT helps the NHS meet sustainability objectives and can be used to provide criteria for the design process and set design parameters for:

- Designers
- Builders
- Procurers
- Operators

New build projects must achieve an "Excellent" NEAT rating. Refurbishments – "Very Good"

5.2 The Output Specification must be explicit about energy efficiency and risk transfer.

5.2.1 Specific Energy Target / Environmental Specifications

The Department of Health requires an energy consumption figure for new build of between 35-55GJ/100m^3. The Trust's advisors need to identify a specific energy target within this range for the specified operating conditions within the hospital, or at least be in a position to negotiate the numbers produced by the bid teams at a later date. This target is important as if it is not met, the PFI contract should require that remedial work is undertaken to ensure that "as built" reflects design intent, and if this is not achieved, that penalty clauses come into effect. The target can also be the basis of any shared pain / gain scheme, although in this case actual monitored energy consumption in the second year is a more likely starting point. In practice there is usually a two year "bedding in" period during the second year of which actual energy consumption can be compared to design targets. The procurer should be aware that some bid teams inflate their energy consumption design calculation so as to minimise their own risk.

The 35-55 GJ/100m^3 target also needs to be understood in the context of the Department of Health commitments to reduce carbon emissions by 15%. An "all electric" solution might minimise energy consumption, but with the current UK generating mix, it would result in higher carbon emissions than an equivalent mixed gas / fossil fuel use system, and it would be more expensive to run, although capital costs may be lower.

A key element associated with meeting the energy target is the form of the building (deep / narrow plan), density levels, the level of internal gains, and what areas are air-conditioned, cooled, mechanically ventilated, or naturally ventilated. Some of the issues here have been discussed in section 2.

The Procurer has to recognise the link between energy consumption and the environmental specification (eg acceptable ward temperatures). The tighter the environmental specification, the greater the energy consumption, all other things being equal. The Department of Health issues documents that specify minimum environmental standards for all health buildings with guidance on achieving these with allowances for some flexibility. Major deviations from these guidelines should be avoided.

There is no agreed optimal solution to this issue, so the important issue is that Trusts are aware of the implications of selecting the different service solutions.

The Procurer should be encouraged to use their advisors (usually building services engineer) to calculate a specific target for the Trust within the 35-55 GJ/100m^3 target range, and to report on the robustness of the bid teams' proposals in meeting this value in the light of e.g. continuing climate change, increase in internal gains, or change in use. The advisor will be expected to provide advice on these issues, but simulation / detailed assessment work will be the domain of the procurer's advisors.

In the context of energy targets and change in use, it should be recognised that in recent years electricity use in the NHS has increased by 7% per annum.

5.2.2 Meeting Energy Use and Environmental Requirements

If the hospital does not operate in line with energy and environmental expectations the contract should require the ProjectCo to undertake remedial work to rectify the situation, or penalty clauses should be incurred.

This requires a clear understanding of assumptions associated with energy use and internal conditions, and possible use of testing to validate elemental performance (e.g. air tightness).

Where such clauses are in place, it is the advisor's responsibility to ensure that the Procurer understands the implications of the contract in practice, and how compliance will be checked.

With such an approach there is often a two year bedding in period, with energy consumption in the second year being compared to design consumption.

5.2.3 Shared Pain / Gain schemes

Given the importance of operational issues anticipated to be under the control of the ProjectCo, on the future energy consumption of the PFI scheme, it is important that some form of shared savings / risk scheme (known by many as a shared pain / gain scheme) is introduced to ensure that the ProjectCo stays focused on energy issues. Such a shared savings / risk scheme means that the Trust and the ProjectCo operator share the responsibility for energy consumption, and take a share of the rewards if energy falls below target levels, and a share of the pain if energy consumption exceeds agreed target values.

If a bedding in period is agreed upon, the target value can be based on actual consumption in the second year, although care is required here to ensure the ProjectCo does not inflate the target. The recommended approach here is to have a separate clause requiring remedial work / penalty clauses in the event that the building does not perform according to standard, and then use the second year as a basis of a "shared savings" scheme.

Many other issues need to be considered so as to establish a successful shared pain / gain scheme:

The percentage risk share is usually 50/50. In practice the responsibility for energy use will be partly with the Trust, and partly with the ProjectCo. The exact division of responsibility will depend on the contractural responsibilities between the Trust and ProjectCo. For example, energy consumption in some areas – eg the level of small power use for medical equipment is under the control of the Trust. It is possible that a more sophisticated risk share agreement is possible, but care needs to be taken in ensuring that any risk share arrangement is fair to both parties, and is not easily circumvented.

Whatever the risk share agreement, there is a need for an annual readjustment of agreed targets in, eg, the light of changes in occupancy periods.

The Procurer has to recognise that the behaviour of building occupants can affect energy performance and as such they have a role in contributing to the achievement of the targets. How this is to be done needs to be recognised within the contract.

The need to provide incentives for hospital users to play their part will play well with bidders if this leads to rewards for achieving performing better than targets and some risk sharing if caps are exceeded. The anticipated Payment Mechanism needs to be provided to the bid team. In the mechanism listed below, there is the inclusion of a "deadband" around the energy target that reflects the uncertainty of energy use in practice. Note – the "deadband" of +/- 5% in the example is illustrative, informal discussions with the PFU have suggested 3.5%, whilst other projects in the DFES use a 10% value.

Shared risk - 50/50
----------5% above target
Trust risk - 100%
==========**Target**
Trust reward (savings) - 100%
----------5 % below target
Shared reward (savings) - 50/50

The energy advisor needs to work with the Procurer to identify a suitable shared savings scheme.

5.3 The design requirements should be flexible and allow a robust solution for energy efficiency

There is the option of actually encouraging bid teams to respond more or less directly to the design used by the PSC. In practice the output specification should identify functional requirements, but leave sufficient flexibility for the bid teams to provide their solutions as part of the competition.

5.4 Energy Targets must be realistic and progress towards them must be measured at each stage

The explicit target of between 35-55GJ/100m^3 needs also to be expressed as an actual energy target giving expected consumptions for each fuel (this should already have been done for the PSC). The Trust needs to specify the requirements associated with the calculation (eg occupancy hours). The expected mix of imported electricity, self generated electricity and fossil fuels expected to be used on the project can be established from the calculation spreadsheet.

5.5 What end uses for energy (volume) risk are being transferred?

This has been covered in section 2. There are a number of alternative approaches in terms of identifying what end uses of energy are to be included as part of a pain / gain scheme. Some have gone for an aggregate total of all energy use. Other PFI projects have limited energy consumption pain / gain share to end uses for which the ProjectCo has direct responsibility eg heating.

5.6 Energy (volume) risk transfer requirements in the Output Specification must be sustained

A fundamental part of any pain / gain share arrangement is that the energy target on which payments are based has to be reviewed, often annually, to accommodate for a range of factors such as change in use, level of internal gains etc.

Recent DH guidance suggests a means of modelling actual energy use against degree day heating data such that climate changes during the course of the year can be accommodated. More sophisticated analyses are possible – eg basing the energy target on the original building energy modelling approach, but it is recognised that there is a balance to be struck between a simple approach that is fairly transparent, but clearly may not be sensitive to actual changes in a Trust, and a sophisticated approach that requires significant input from the procurer and ProjectCo to record and analyse data. Usually the more sophisticated approach, the more opportunities there are to "rationalise" actual energy use to demonstrate compliance with the target.

5.7 Allow for risk sharing and agreed target resetting

Detail of risk sharing is covered in the Payment Mechanism and needs to be highlighted in the output specification (see earlier).

The Payment Mechanism model has a detailed procedure for adjusting targets, attention needs to be drawn to this in the output specification or possibly summarised as follows:

"Adjustments to the Annual Utility Service Targets may be made annually upon the anniversary of the Service Commencement Date on a fair and reasonable basis where the following has occurred:

- there has been a material change in respect of the utilisation of the hospital

- additional equipment having a material impact on utility consumption has been introduced or existing equipment removed by the Trust
- a Variation has been issued so that the usual consumption levels relating to any Utility will change or have changed
- one Utility is replaced by a different Utility (e.g. oil is replaced by gas).

5.8 Allow for technology improvements.

The use of a shared pain / gain scheme can include the mechanisms by which future capital investments that might be made by the ProjectCo to benefit the Trust by way of reduced energy use, might be funded. There are instances in PFI agreements where this detail has been developed "by mutual agreement" during the operation phase of the buildings, but this does entail a degree of "Partnership" between the Trust and ProjectCo.

5.9 Define Operational Requirements

Minimum environmental standards are detailed in NHS Guidance, in the output specification and its annex. Occupancy details are required including:

- hours of use (including core hours and opening hours)
- number of occupants
- activities (low, normal, high levels of physical activity).

The Trust normally appoints advisors who are able to include existing NHS energy and environmental requirements for each of the areas of the new building (e.g. Theatres, ward areas etc).

5.10 Define Facilities Management Requirements

This issue is covered in the various model output specifications (service level specfications) which include Utilities Management, Waste, Grounds & Garden, Pest Control, Car Parking, etc. Currently available model output specifications are available from:
http://www.dh.gov.uk/ProcurementAndProposals/PublicPrivatePartnership/PrivateFinanceInitiative/StandardContract/fs/en

5.11 Utilities Protocol

Trust and ProjectCo. must refer to NHS Standard Service Level Specification on Utilities Management v2, 4th ed. The requirements of this document must be reviewed and adapted on a case-by-case basis.

5.12 Encourage the use of renewable and low carbon technology

This issue may be incorporated in a dedicated output specifications. In such instance the payment mechanism (schedule 18) should be designed so that it adequately reflects the negotiated risks and benefits sharing associated with renewable / low carbon technologies.

5.13 The Payment Mechanism must identify utilities payments, risk and shared risk clearly

In addition to suggestions made elsewhere within this document, the DH Private Finance Unit (PFU) is now developing a revised payment specification, and as such the Procurer should be encouraged to discuss proposed payment mechanisms with the PFU.

5.14 Setting and revising consumption targets/caps

Refer to Schedule 18 Payment Mechanism

The model Payment Mechanism should requires benchmark consumptions for fossil fuels and electricity (core hours and out of hours) in kWh / m^2 and an Annual Utilities Services Consumption Target but does not relate these to the required carbon target. A reminder of this needs to be included in the Payment Mechanism text, or carbon equivalents for the volumes could be required. The end uses included in the target also need to be included.

Risk and shared risk are not clearly identified in the current PFI model payment mechanism, but the DH PFU are likely to bring out a revised payment mechanism in the near future.

Adjustments to consumption targets will need to be included in the payment mechanism.

5.15 Managing "bedding in" periods

Many shared pain / gain schemes are based on actual energy consumption in the second year of operation – the first being a bedding in period where continued commissioning / low occupancy levels mean that energy consumption is not a good record of future intent. The Trust may carry the full costs of the utilities in the first year (or a specified shorter period), and by the end of the second year the ProjectCo should have corrected any defects or penalty clauses should be instigated. The operational performance over the second year can be used as the basis of a target for a pain / gain scheme, if the original design target is not to be used (see section 5.2.2). Clearly the procurer should form a view on the validity of the energy use data in setting targets over the two years, and provision should be made in the payment mechanism for a review of targets under "reasonable" circumstances.

5.16 Maintain energy efficiency aspirations from output specification

The Payment mechanism needs to relate the agreed energy targets to the output specification requirements. This may be complicated by out of hours use, the text needs to include a requirement for the consumption to reflect the agreed carbon targets.

6. "Bidder Information" Checklist

The checklist provided on the following pages lists the issues that should be considered –and where applicable implemented – associated with module 2. This stage of the process is key for the Trust to ensure that its project aspirations are clearly communicated to the bid teams.

Module 2 – "Bidder Information", Hospitals

	Check	Requirement	Measure	Output	Action
1	Does the Output Specification define what the procurer wants to achieve re energy? Is the energy target realistic given environmental requirements?	▪ Energy requirement and risk transfer is clearly stated in a separate section in the Output Specification. ▪ Bid teams encouraged to do better than the energy target ▪ Environmental conditions are clear and are contained in eg the room data sheets ▪ Contractor responsibility is clear if actual energy use exceeds design eg due to construction defects	▪ Output / payment mechanism includes: ▪ Energy target ▪ Remediation / penalty clauses if energy consumption doesn't meet design targets ▪ Shared pain / gain scheme ▪ Future investment in energy efficiency ▪ Clear environmental standards consistent with clinical care and NHS guidance		
2	Is Output Specification explicit about risk transfer?	▪ Transfer of volume consumption risk to Project Co with preferred options for shared risk and reward ▪ Approach shared with DH PFU	▪ Clear definition of levels where risk or benefit of savings are retained or shared. ▪ Outline of approach to be adopted for on-going review of targets		
3	Are the design requirements flexible and allow a robust solution for energy efficiency	▪ Match environmental standards given in NHS Estates Guidance documents HBNs and HTMs. Significant deviations should be avoided. ▪ Impacts of specific design requirements on energy consumption should be identified. ▪ Trust clearly sets out means of assessing Robustness	▪ Approach on robustness of design, and its relative importance as an assessment criteria identified. ▪ Energy impact of environmental requirements and associated tolerances are recognised, these requirements are no more demanding than is commensurate with good clinical care.		
4	Ensure progress towards energy targets measured at each stage in the PFI process	▪ Allowance for review of energy use at all stages of the bidding process.	▪ Process map / energy intervention points recognised by Procurer, and specific review activities scheduled in.		
5	Are the end uses for energy (volume) risk that are being transferred identified?	▪ All consumption for heating, lighting ventilation and cooling at least should be included in the risk transfer (share) agreement. Process use only identified separately.	▪ All end uses included as part of shared pain / gain scheme identified, and means of assessing actual consumption against targets agreed.		
6	Is there an option for risk /reward sharing?	▪ Risks and rewards are shared between ProjectCo and Authority reflecting their responsibility for energy use.	▪ Risks and reward share scheme approach (including establishment of eg changes in use, hours etc) detailed, and agreed with DH PFU.		
7	Is there a mechanism for encouraging the retrofitting of energy efficiency measures during the life of the building as	▪ Mechanisms that allow the introduction of improved technology included, eg made on a shared costs and savings basis. ▪ Approach circulated to DH PFU	▪ Specific clauses in payment mechanism		

Module 2 – "Bidder Information", Hospitals

	Check	Requirement	Measure	Output	Action
	Technology improves?				
8	Is there provision for the use of renewable and low carbon technology, or of ways of retrospective installation when economics allow?	▪ Initially a feasibility study of the use of renewable energy and low carbon technologies must have been undertaken.	▪ Specific clauses in payment mechanism		
9	Is there provision for managing "bedding in" periods	▪ Procedures should be in place to ensure that energy is not being consumed over the anticipated level during the bedding in period as this with skew the benchmarking.	▪ Energy consumption should be regularly compared with estimated use.		
10	Energy management / review procedures	▪ Use of independent reviewers on an ad hoc or specified frequency to review the energy performance, and overall energy management of the PFI project, with action on the basis of the conclusions	▪ Ensure Trust has the opportunity to challenge future energy use values (and review the payment mechanism if need be), and energy management approach. Ensure that there are opportunities to ensure action as a result of future energy audits.		

PFI / PPP Procurement Support Pilot Programme

CARBON TRUST

Making business sense of climate change

Module 3: "Evaluation of Bids and Negotiations Up To Financial Close", Hospitals

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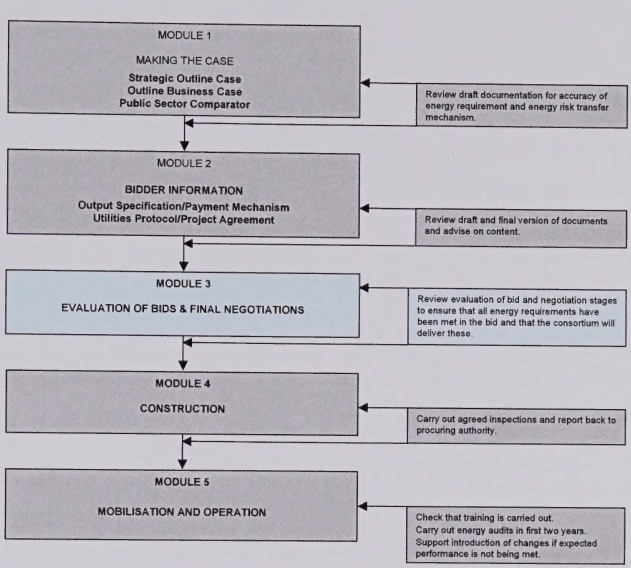
This document has been produced by Atkins Faithful & Gould and FaberMaunsell (Sustainable Development Group) on behalf of the Carbon Trust, May 2004. This is one of a series of 5 modules that cover the PFI Process.

Module 3: "Evaluation Of Bids And Negotiations Up To Financial Close", Hospitals



1. Introduction

Module 1 covered the Trust's strategic objectives and priorities.

Module 2 covers the need for the energy and carbon saving content of the Output Specification to be highlighted as having some significance in the bidder selection process.

Module 3 covers the bid evaluation process and final negotiations up to Financial Close. It is important that compliance with the energy requirements is not overlooked in the evaluation and selection process. The actual evaluation process must have a focus on energy and ensure that omissions or vague responses in the bid are not overlooked.

It is important that both the strategic and detailed Trust requirements in Modules 1,2 are assessed during the bid phase (Module 3), and that bid teams are aware at the start, with suitable reinforcement during the bidding process, of Trust requirements and of how bid evaluation will be undertaken. Once preferred bidder / financial close stages are reached, it is important that the Trust priorities and objectives included in the successful bid are not negotiated away, with the need for specific guidance on the small print around specific contract clauses such as "shared pain / gain" schemes. It is also important during the bidding phase that consideration is given about how the agreement can be successfully enforced during construction and operation.

2. Interventions

It is recommended that five interventions are undertaken at this stage of the procurement process, at the following points:

1. Advise on bidder selection process (PQQ/PITN if appropriate)

2. FITN (Final Invitation to Negotiate). Selection of bidders.
3. BAFO (Best And Final Offer), at first bid receipt and selection of preferred bidder (2)
4. During Negotiations to Financial Close
5. Immediately before Financial Close

The intervention requirements in the checklist may not all be appropriate to each stage.

3. First Evaluation of the Bids

3.1 Ensure that the environmental requirements and energy targets in the Output Specification have been considered.

Evaluation processes and matrices often emphasise the financial evaluation. Utilities and energy processes are included in "bid quality" evaluations and then as part of the overall Facilities Management assessment where energy has a small weighting. This allows the bid to be successful without taking account of these requirements. To overcome this quality and energy requirements need to have a prominent weighting in the bid or be evaluated on a pass/fail basis if any of the following are not achieved:

- The bid must include the agreed energy model demonstrating that the energy target has been met.
- The bid team should identify how it has included whole life costs in consideration of the design and proposed operation of the hospital
- The energy model must be scrutinised to ensure that all the environmental requirements have been met, such that conditions required within the hospital will be met (eg temperatures, air change rates)
- That the proposed design is "robust" in the face of eg change in use issues.
- The financial costs of the energy volumes must be included correctly

3.2 Check that the consortium members have a good record on energy issues and whether they have worked together before with good results in this area.

- The bid should include details of previous experience in providing energy efficient facilities that met the requirements of the procuring authority.
- The bid should include details of the relationship between the consortium members that ensure that design and construction members of the consortium will take a share in the risk of the facility not achieving the energy requirements.
- The Trust may wish to visit other hospital facilities developed by key members of the ProjectCo to review track record. Although issues such as previous "NEAT" scores, and energy design targets, are an indication of performance, claims need to be carefully validated.
- During the course of the bid team's design development, the Trust can hold review meetings to look at the ways the different bid teams are approaching the design, and the ways in which energy life cycle issues have been included.

Overall, intervention in this stage takes the form of ensuring that the Trust's energy priorities and requirements are fully recognised by the bid teams, and that bid teams are given notice during the bid process if they appear not to be properly addressing energy issues. At the selection stage the Trust may decide to reject bid teams that fail to meet all of the energy requirements, and it is in discussions with bid teams during bid evaluation that clarification needs to be undertaken over any aspects of eg the payment mechanism where bid teams have put forward alternatives or variants to the Trust's requirements.

4. Further Negotiations and Financial Close

4.1 Ensure that there is no conflict between the design and operational targets for energy

During The Best and Final Offer Stage (BAFO) of the process the requirement to meet the energy and environmental requirements must be maintained. Evaluation of the design using an agreed dynamic model should be undertaken by the bid teams, and presented as part of the bid team evaluation.

Following the selection of the Preferred Bidder the requirements for energy volumes and transfer of risk must then be maintained in the process leading up to Financial Close. There are three main requirements:

(i) Should the operational performance of the building not meet design requirements (in terms of energy or environmental conditions) – the ProjectCo should be expected to undertake remedial work to meet design requirements, or alternatively should face penalty clauses. This is an area of risk transfer that is resisted by some ProjectCo. Inevitably this requires some period of evaluation during commissioning and early operation. The evaluation period varies in practice, but a period of two years has been used by some with performance tests being completed as part of commissioning / early operation, and the second year's energy consumption being compared to the design target.

(ii) An equitable division of risk is maintained between the Trust and ProjectCo as part of a shared pain / gain scheme covering energy use. The bidder must be content that there is provision for adjusting energy targets arising from changes of use of the facility, and that these targets may be adjusted downwards as well as upwards.

(iii) The basic design approach is inherently energy efficient, and robust in terms of eg change in use.

The period between the selection of the preferred bidder and financial close often sees major changes to the hospital's design. These changes must be reviewed in terms of the impact of energy consumption, and Trust requirements associated with energy maintained.

An important part of the advisor role to the Trust at this stage is that the successful design must be evaluated for impacts on the agreed energy target, and that energy objectives should not be lost in successive discussions.

Financial close is another occasion where financial considerations can lead to energy efficiency measures being lost - life cycle costs should be emphasised as part of discussions.

Support will be provided to the Trust in final negotiations if the successful bidder attempts to weaken the energy obligations. The support will be on the basis that the energy requirements were made clear to the bidder at all stages, otherwise they may be in a position to threaten to withdraw.

5. "Bid evaluation and Negotiations" Checklist

The checklist provided on the following pages lists the issues that should be considered –and where applicable implemented –during the Evaluation of Bids and Final Negotiation stages of the PFI process. This stages of the process are key because they largely seals the design outcomes. The "Evaluation of Bids" stage is important in that the Trust needs to check that the bidders are getting what they want, and the "Final Negotiation" stage is important because it often results in major design changes, the energy implications of which should be understood. It is also the stage where there is much "horse trading" over contractural clauses and specific design features.

Module 3 – "Evaluation Of Bids And Negotiations Up To Financial Close", Hospitals

	Check	Requirement	Value	Finding	Action
	Bid Evaluation				
1	Are Output Specification targets, and Payment Mechanism requirements recognised and included in bid documentation?	The documentation received with the bid must identify targets and requirements. The various caveats or alternatives should be clarified, and implications noted.	▪ Energy target within range 35-55GJ/100m3. ▪ Remedial work or penalty clauses if actual consumption exceeds design requirements. ▪ Shared pain / gain scheme accepted on energy volume risk. Are the detailed requirements of shared savings schemes workable in practice, or are there too many "get out jail" clauses in the proposal.		
2	Have the bidders accepted the method for updating the payment mechanism	Acceptance of payment mechanism	▪ Mechanism for updating the payment mechanism is included. ▪ Impact of variations on Trust – are the proposals implementable in a fair way		
3	Have the bidders provided a design capable of being robust	Energy estimates, simulation if available	▪ Overall assessment of design simulations – have reasonable assumptions been used ▪ How do the design simulations demonstrate robustness?		
4	Have the bidders approaches included caveats that side-step project objectives	Review bid teams – relative compliance with Trust energy targets and requirements	▪ Assessment of relative performance ▪ Assessment of areas of "clarification" from the Trust ▪ Consultation with DH PFU over payment mechanism if necessary		
5	Have all members of the bid team, especially the Facilities Managers, been involved in decisions relating to energy efficiency.	All ProjectCo members have considered energy implications of design.	▪ Trust evaluates whether energy efficiency has been considered by all ProjectCo team members.		
	Bid Evaluation Matrix				
6	Does Scoring system enable energy to be traded off against unrelated design objectives?	Energy requirements should have some weight.	▪ Value of energy in overall score.		
7	Was advice sought from advisor in development of scoring system?	Discussions with bid manager, sample scoring system	▪ Yes / no		
8	Has a scoring system with pass/fail parameters, including	If energy and risk do not pass a minimum score the bid fails.	▪ Yes or no		

Module 3 – "Evaluation Of Bids And Negotiations Up To Financial Close", Hospitals

	Check	Requirement	Value	Finding	Action
	energy targets and risk transfer, been considered?				
9	Use an evaluation system with flexibility to demand re-referral of fail items	If bid fails, bid is referred back	▪ Yes or no		
10	Has robustness of design been included as an assessment issue	Means of assessing robustness accepted and implemented	▪ Quality of approach		
11	Has energy consistently been considered during all stages of the bid teams design process	Evidence that energy has been considered at all relevant stages. Evaluation of bid team approach during development as well as at end	▪ Trust has made the requirement for energy to be considered at all stages clear to the b id team ▪ Clear evidence of compliance from bid teams		
	Bidder Record				
12	Do the **Bidders** have a good record in energy conservation issues?	Evidence supplied with bid and positive comments from due diligence advisors.	▪ Good, Adequate or Poor.		
13	Do the **M&E Designers** have a good record in energy conservation issues?	Evidence supplied with bid and positive comments from due diligence advisors.	▪ Good, Adequate or Poor.		
14	Do the **Architects** have a good record in energy conservation issues?	Evidence supplied with bid and positive comments from due diligence advisors.	▪ Good, Adequate or Poor		
15	Do the **FM Providers** have a good record in energy conservation issues?	Evidence supplied with bid and positive comments from due diligence advisors.	▪ Good, Adequate or Poor		
16	Do **other consortium members** have a good record in energy conservation issues?	Evidence supplied with bid and positive comments from due diligence advisors. Visits to other completed hospitals to view performance	▪ Good, Adequate or Poor		
17	How is risk shared within the consortium	If building does not perform as required, is there a clear division of responsibility within the ProjectCo	▪ Yes or no.		
	Negotiations				
18	Avoid risk transfer back from bidder in negotiations.	Check bid documentation for changes to payment mechanism.	▪ Are changes acceptable? ▪ Keep a log of major relevant changes and associated consideration of energy use		

Module 3 – "Evaluation Of Bids And Negotiations Up To Financial Close", Hospitals

	Check	Requirement	Value	Finding	Action
19	Are the preferred bidders trying to transfer risk associated with variance from design targets and requirements back to the Trust	Ensure a fair assessment of whether building is performing to specification, but ensure contract requires remedial work / penalty clauses	▪ Final agreement – fair transfer of energy risk		
20	Is there an energy end use where the bidder is keen to avoid exposure to volume risk?	Volume risk can be avoided in "Process" end uses only.	▪ No avoidance of volume risk for environment uses.		
21	Can end uses volume risk be separated?	Metering available to identify end uses.	▪ Metering acceptable.		
22	Are all parties satisfied that responsibility for consumption is lodged where it is best controlled	Environmental uses with ProjectCo and Process Use with occupier.	▪ Yes or no.		
23	Is shared risk provision adequate to incentivise future energy investment?	Bidder sees reward from system if savings are made.	▪ Appropriate mechanism in place to encourage future energy efficiency investment by ProjectCo, and clear mechanism for Trust to use alternative energy efficiency investment strategies if no agreement can be found.		
24	Are all parties satisfied with the operation of the Payment Mechanism?	Accept risk transfer and targets.	▪ Yes or no.		
25	Does the Payment Mechanism have provision for future changes in circumstances?	Allowance for target adjustments for changes of use, occupancy etc.	▪ Provision acceptable. ▪ Clear means of assessing energy management performance of the ProjectCo ▪ Clear procedures for reviewing payment mechanism ▪ Clear mechanism for reviewing energy targets and any "normalisation" factors		

PFI / PPP Procurement Support Pilot Programme

CARBON TRUST

Making business sense of climate change

Module 4 – "Construction", Hospitals

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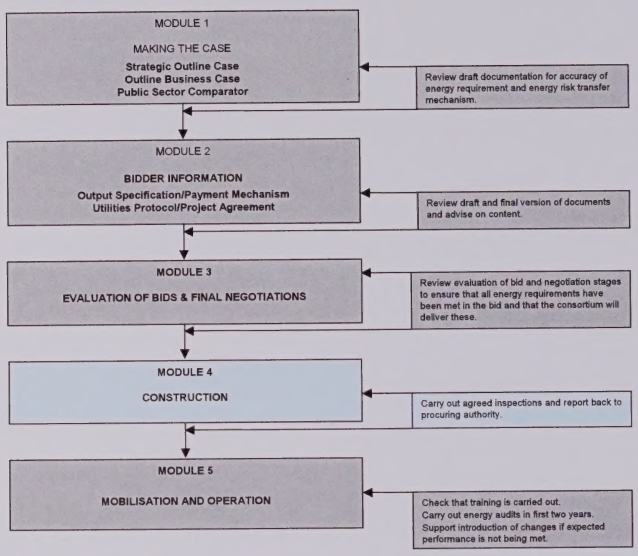

1.Introduction

Module 4 relates to the construction period. Reviewing activities during the construction period is important as it links activities leading up to, and completion of "Financial Close", (module 3) with the operational phase of the building. There are a number of specific areas where the energy advisor may be expected to intervene. These include:

- Advising the Trust on the areas of performance testing and evaluation required to demonstrate compliance (these should already be in the contract), and interpreting the results of tests if necessary.
- Design sometimes changes during construction, and the advisor should assess the impact of any major change on energy efficiency, and advise accordingly.
- Work with independent certifiers to review the impact of building defects or changes in approach on energy implications. Ensure ramifications for shared pain / gain schemes etc are understood. It is not the role of the energy advisor to undertake the necessary tests, but to advise on the results, and if necessary to ensure that the test procedures are being competently undertaken and reported on. Traditionally the independent certification process has not provided a specific input on energy issues.
- Ensure that the Trust is aware of the importance of commissioning, the log book etc, and that contractural issues associated with the construction and commissioning phase are completed.

Maintaining the required construction standards is also in the interests of the facility operator and the relationship between the builder and the operator over energy issues needs to be developed.

The Trust should have agreed a specific set of inspection schedules to ensure that the specification is not being amended without consideration of energy issues. Variance identified here will be assessed and the findings made known to the ProjectCo as well as to the Trust. A final inspection and audit will be undertaken before handover, with the advisors role being to review specifications of such

inspections and audits, and review results if need be, Actual inspection and testing will be the responsibility of a third party.

Inspections will be to ensure that the construction and installation conform with:

- the specification
- the parameters used for energy modelling and targets.

2. Inspection Schedule

The contractor must provide a critical path of the construction process, identifying milestones where inspection could occur to ensure the energy design targets are being met. This inspection will be carried out by an independent advisor done by an independent third party and confirmed in the form of a checklist developed specifically for the project. The same checklist can be re-visited on the occasion of each site visit to ensure that faults have been rectified.

3.Suggested Inspection Tests and Checks during construction

The following tests are ones that could be suggested by the energy advisor:

Test 1: Fabric Test

- During installation of the walls/doors/insulation - check the insulation type and levels to ensure adequacy and continuity in accordance with the specification, including evidence of measures to minimise infiltration
- That the key parts of the fabric construction are signed off (including the detailing) to minimise thermal bridging, and unwanted infiltration.

Test 2: Mechanical and Electrical (M&E) Test

- Ensure the appropriate M&E equipment is installed, i.e. pumps, pipes, ducts etc. are sized and installed to specification and with sufficient insulation.
- That the lighting is installed correctly as in the specification, taking account of luminous efficacies, spacing of luminaries and controls.
- That the specified luminance reflection is achieved from the Fixtures and furnishings, surface finishes, paint etc.
- That the M&E is correctly commissioned and appropriate O&M manuals are supplied.

Checks

Construction Site Management

- ProjectCo. should be required to monitor, record and report on energy and fuel consumption used on site during construction.
- ProjectCo. should be required to comply with the Consider Constructors Code of Practice, this practice.

4. Suggested Inspection Tests and checks on completion

The following tests could be suggested by the client advisor (recognising that they should be identified at an earlier stage in the PFI process):

Test 3: Commissioning Check

Proper commissioning of the plant is crucial for ensuring the building will deliver to the design specification, and all too often this stage is not properly addressed. There will be pressure from all sides to complete it quickly to enable occupation of the building, but this should be resisted if it means compromising the integrity of the commissioning.

Commissioning checklists must be completely filled in and be comprehensive. The controls commissioning is most important for future energy performance. It should include a systematic and thorough method of establishing the control integrity of:

- The software commands from the BEMS to the outstation outputs.
- the output of the outstation and the state or setting of the plant (wiring)
- Measured values reconciled with the BEMS readings of the sensors
- the states of plant and the state reported by the BEMS
- Time schedules

Test 4: Optional Pressure Test if applicable

The list provided on the following pages provides the issues that should be considered –and where applicable implemented – during the construction stage of the PFI process as a guide to the advice that should be provided by the energy advisor. This stage of the process is key for the Trust to develop the project aspirations and set the framework for energy and other sustainability issues to be considered throughout the PFI process.

Test 1: Fabric Test	Check	Parameter
During installation of the walls/doors/insulation - check the insulation type and thickness to ensure adequacy and continuity in accordance with the specification, including evidence of measures to minimise infiltration	Observed U value of wall/roof/ floor/window insulation - same as specification?	Sample Wall U value
		Sample Window U value
		Sample Floor U value
		Sample Roof U value
Airtightness to 50 Pa (CIBSE TM23) test for buildings greater then 1000m^2	Witness air tightness test and remedial works, air permeability to be less than 10 m^3/m^3/hour	Permeability
Certificate or declaration that provisions of Part L2 with respect to continuity of insulation are adhered to OR infra-red thermographic inspection	Spot check work quality, confirm with declaration or inspection images	Declaration by suitably qualified person

Test 2: Mechanical and Electrical (M&E) Test	Check	Parameter
Ensure the appropriate M&E equipment is installed, i.e. pumps, pipes, ducts etc. are sized and installed to specification and with sufficient insulation.	Check motor sizes against specification unless VSD controlled	Difference between fan pump rating and specified
Ensure the appropriate M&E equipment is installed, i.e. pumps,	Check pipework insulation thicknesses	Insulation thicknesses

pipes, ducts, boilers, valves etc. are sized and installed to specification and with sufficient insulation.	and their conformity to specification	
That the lighting is installed correctly as in the specification, taking account of luminous efficacies, spacing of luminaries and controls.	Check installed lumens/ circuit Watt against specification	lumens/ circuit Watt for main areas
That the specified luminance reflection is achieved from the Fixtures and furnishings, surface finishes, paint etc.	Note colours of important reflective surfaces, especially ceiling and around windows	Colours
That the M&E is correctly commissioned and appropriate O&M manuals are supplied.	View commissioning sheets (as per TM 1 from the Commissioning Specialists Association)	Commissioning Sheets
Considerate Constructors' Code of Practice	Ensure that the site has registered to the code.	At least 3 out of 5 in each category should be achieved.

Test 3: Commissioning Check	**Check**	**Parameter**
The software commands from the BEMS to the outstation outputs.	View commissioning sheets from the M&E contractor	Commissioning Sheets
The output of the outstation and the state or setting of the plant (wiring)	View commissioning sheets from the M&E contractor	Commissioning Sheets
Measured values reconciled with the BEMS readings of the sensors	View commissioning sheets from the M&E contractor	Commissioning Sheets
The states of plant and the state reported by the BEMS	View commissioning sheets from the M&E contractor	Commissioning Sheets
Time schedules	Check against occupancy times assumed in simulation or during establishment of design target. Is there drift?	Occupancy Schedule

5. Design Variations During Construction

The Trust's advisor's main roles should be to act as a client advisor on any changes in approach agreed during construction to the specification in terms of energy efficiency, and to assist in the interpretation of test results.

The energy advisor will need to form a relationship with the ProjectCo as well as with the Trust given the timetable of changes associated with the construction process. It is important that agreed changes during construction do not invalidate other contractural clauses that relate to energy – e.g. That an agreed change during construction doesn't invalidate the requirement for the building to perform to the original environmental and energy specifications.

6. Glossary

KPI – Key Performance Indicators
TUPE - Transfer Of Undertakings (Protection Of Employment) Regulations 1981 (TUPE)

7. "Construction" Checklist

The checklist provided on the following pages lists the issues that should be considered –and where applicable implemented –during the Mobilisation and Operation stage of the PFI process. This stage of the process is key for the Trust and ProjectCo to manage, occupy and operate the building in an energy efficient manner, whilst ensuring that project aspirations set at the start of the process have been realised.

	Check	Requirement	Output	Requirement Met	Required Action
1	Impact of design changes during construction.	Assess the impact of any major change on energy efficiency, and advise accordingly	▪ Review design changes. ▪ Recommendations and actual outturn ▪ Impact on eg payment mechanism?		
2	Advising the Trust on the areas of performance testing and evaluation is required to demonstrate compliance with design.	The Trust recognises the areas required for performance testing and evaluation.	▪ Interpretation of test data and, if need be, validification of data associated with performance testing and evaluation.		
3	Work with independent certifiers to ensure "as built" is as per design. And evaluate the energy implications of any defects.	Ensure energy implications are provided to Trust alongside the independent certification process.	▪ Summary to Trust. ▪ Specific impacts regarding energy and eg the payment mechanism.		
4	Ensure that the Trust is aware of the importance of commissioning, the log book etc, and that contractural requirements associated with the construction and commissioning phase are completed.	Importance of commissioning with Trust is understood Contractural requirements met.	▪ Advice to Trust on commissioning. ▪ Assessment of actual v contractural commitments, and impact on energy use, and eg the payment mechanism.		

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Module 5: "Mobilisation & Operation", Hospitals

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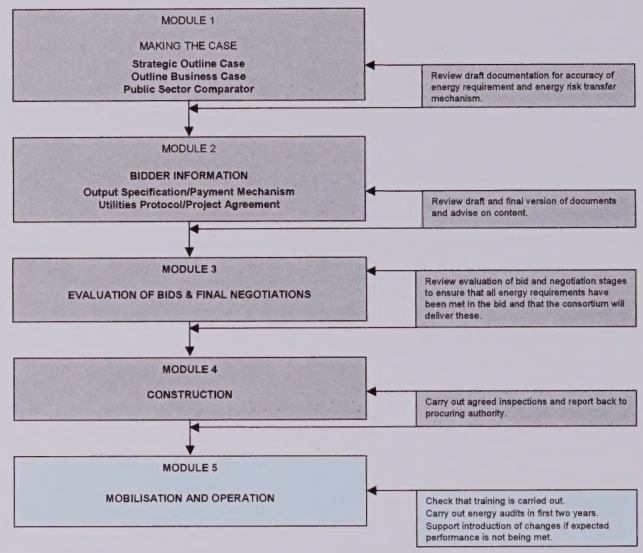


1. Introduction

This module includes guidance on the following;

- Post Occupancy Testing
- Energy Audits
- Benchmarking
- Shared Savings Scheme
- Information Sources
- TUPE
- Variation to contract
- Delivery not as expected
- Checklist for project advisor

The mobilisation period includes the start up operation of the building as systems begin to be used. The operation period as specified in the contract will usually range from 15 – 35 years, with the ProjectCo having to ensure that the main services of the building are fit for use for a given period after that date.

This Module should be read in conjunction with the other Module documents in this series that cover the PFI process. At the end of this document a checklist is provided to ensure that the energy & sustainability issues highlighted in this module have been considered.

To help ensure the operation of a more energy efficient building it is important that a partnership is established and maintained between those working in the building and those maintaining and managing it. Communication between these parties will be key. Therefore it is important that the means of communication is established from the outset.

The table below suggests some key intervention points where there may be an opportunity for changes to be implemented. Advisors and Trusts will need to refer back to the issues covered in previous Modules to see if some of the points were addressed e.g. development of KPIs. Where these issues are not included the Trust may wish to consider a revision (variation) to the contract. The overview Module and Modules 1-4 should be referred to whilst using this document as many issues will need to be included at the contract stage for the ProjectCo to take account of during the operation of the building.

2. Stages in Mobilisation & Operation

2.1 Inception	
2.1.1	Post occupancy testing / Design v operational energy use
2.1.2	Design v actual energy consumption / "bedding in" period / Energy Use baseline
2.1.3	Energy management responsibilities
2.1.4	Training for Facilities Management Staff and site users
2.1.5	TUPE
2.2 Annual frequency	
2.2.1	Key Performance Indicators (KPIs).
2.2.2	Response to legislative changes
2.2.3	Normalising actual energy use with baseline conditions
2.2.4	Performance feedback – relationship between ProjectCo operator and Trust
2.2.5	Training / education
2.3 2+ year frequency	
2.3.1	Review of payment mechanism. Is the shared pain/gain scheme working?
2.3.2	Equipment renewal/ replacement programme
2.3.3	Formal energy audit to review performance
2.3.4	Review of opportunities for new, more energy efficient equipment

The following guidance gives more detailed explanation on some of the key intervention points listed above. The advisor should also refer to the checklist at the end of this document, to ensure that the issues are being addressed. Further guidance on many of these issues can be found in the information sources section later in this report.

2.1 Inception

2.1.1 Post occupancy tests

Post occupancy tests should be undertaken on completion of the building. The post occupancy evaluation programme must be identified before final agreement of the contract, as post occupancy tests will form part of the implementation of the contract in terms of ensuring operational aspects of the building meet design requirements. The contract should clearly state what the tests will be, and how the penalties associated with non-compliance of design activity. Where independent tests are required (eg air tightness, evaluation of commissioning), the contract will need to have agreed how the independent evaluation will be conducted. Independent evaluators are normally appointed to undertake many of these tasks.

Clearly there are many issues that can be included in post occupancy evaluation. Some of the major areas that should be expected as part of commissioning (which although it should be dealt with under "Construction", it may be completed during whilst the building is occupied) are:

- Air Tightness – as detailed in CIBSE TM23: 2000
- Air change rates / air quality – specify

- Controls Strategy / successful commissioning – see BSRIA / CIBSE Commissioning guides and codes
- Environmental Conditions – can either be evaluated under design load conditions (as part of commissioning), or through monitoring of performance during actual operation.
- Patient and employee satisfaction (not necessarily something that can be specifically included in the contract, but a good indicator of whether the building is performing well

If necessary, an evaluation of satisfactory completion of the controls strategy could also be verified through the monitoring and logging of:

- Internal and external temperatures;
- Controls algorithms;
- Optimisers;
- Pump / boiler / chiller on/off times;
- Set points;
- Valve/damper/VSD settings.

These need to be analysed to view each line of control in the strategy being implemented. This process should be followed during both heating and cooling demand conditions.

2.1.2 Design v Actual Energy Use; "Bedding In" Period; Energy Use Baseline

It is important that the ProjectCo ensures that actual energy consumption is consistent with design calculations. Any significant difference may be due to one or a combination of issues including:

- Design, construction, or commissioning shortcomings
- ProjectCo - operational issues, including poor maintenance, operation of plant
- Trust – operational issues, including change in use / occupancy period etc
- Trust / ProjectCo – operational issues, including failure to collectively resolve energy management responsibilities / joint working

It is clear that it is reasonable to hold the ProjectCo to account for excessive energy use associated with its actions, and that failure to meet energy targets eg due to construction defects should either be remedied by the contractor, or suitable penalty clauses implemented. This requires that such clauses, and a clear assessment of responsibility for excessive energy use, is included in the contract. This latter point is the major issue – how to identify "fault", given that the prediction of energy use will include issues such as operating hours and function that are unlikely to be exactly met in practice, and that the first year's operation of the new hospital buildings will in any case be subject to a huge number of variations as the buildings become operational.

It is for these reasons that some Trusts go for a two year bedding in period: the first to allow for commissioning, and full occupancy; the second where actual energy consumption is compared to design. Requirements for remedial work can be identified from shortcomings during either year, but this requires that such remedial work is successfully identified. A formal energy audit can also help resolve any uncertainties about responsibility for excessive energy use, although it is possible that the PFI contract may call for an independent assessment, rather than a client advisor, here. Comparison of design against actual energy consumption in, for example, the second year needs to normalise actual energy consumption against various factors. The Department of Health (DH) Private Finance Unit (PFU) has suggested the use of a simple degree days correction approach. More sophisticated procedures are possible (eg use of building modelling to include change in use) are possible, but there is no consensus as yet as to the best way of normalising data given the range of PFI projects in terms of areas covered by the PFI agreement. Clearly this is an area where an energy advisor can make a major input. Many of these issues will be included in the Payment Mechanism.

If there is no contract clause relating to variations in design against actual energy use, or the contract is sufficiently vague that the ProjectCo need not worry about meeting its requirements, there is a need to closely monitor energy consumption during the initial "Bedding In" period as this is often used to calculate the baseline energy consumption associated with a shared pain/gain scheme.

An agreed period e.g.2 years, could be allowed for energy use to be monitored to allow annual estimates to be developed. Volume and tariff risk during thisi initial period could be shared to incentivise efficient usage and deter ProjectCo from allowing too high a figure in their proposals. In the case of two years, the second year acting as a baseline for the shared pain / gain scheme. Clearly monitoring is required to ensure that operating practices during such a period are "reasonable" in that the ProjectCo are not operating plant to increase energy use such that future energy targets are more easy to achieve.

At the end of the "bedding in" period the Trust and ProjectCo will need to set a baseline energy target for any shared pain / gain scheme. This can be based upon the average monthly energy consumption of the preceding year amended in the light of any changes in use / exceptional events. This baseline will be the basis for one part of the shared pain / gain schemes, which has been suggested as part of the payment mechanism in Module 2 of this guidance document.

As such it is important to identify how this benchmark will be normalised at the end of the year in the light of various changes within the hospital. In this context the adjustment mechanisms are likely to be the same as for the design / as built energy consumption comparison identified earlier. In many ways shared pain / gain schemes are similar to Contract Energy Management schemes, so guidance (see Action Energy publications) there can assist.

Comparison of actual energy use against the baseline at the end of each year will need to accommodate a number of factors. In practice there is a balance between having a complex series of adjustments that may require substantial effort to assess and interpret, and a more simple measure that allows a straightforward comparison of the two values – eg based on simple normalisation of weather data. A number of normalising factors may be included including:

- Weather
- Operating hours
- Changes in internal gains due to small power loads
- Changes in occupancy density
- Changes in building services

2.1.3 Energy Management Responsibilities

At the outset of the project ProjectCo & the Trust should review the energy management matrix covered in appendix a, and identify areas of respective responsibility, and where joint action is required, and how that joint action should be undertaken. Independent energy audits which should include a review of the energy management matrix should be undertaken periodically for the duration of the contract. Further guidance can be found in the section headed "Information Sources".

2.1.4 Training for Facilities Management Staff and Site Users

The Trust should have identified the training requirements for its staff on the operation of the building at the contract stage, and these requirements should be enforced during this stage. Requirements for the training of Facilities Management staff will depend on the division of responsibilities for FM between the Trust and the ProjectCo. The Trust should ensure that there is sufficient attention to training of staff even where the ProjectCo is responsible for FM.

2.1.5 TUPE (Transfer of Undertakings (Protection of Employment) Regulations 1981)

TUPE, in itself, is not an issue for the energy advisor. However, it is recognised that as part of PFI many staff will be TUPE'd over to the ProjectCo for the duration of the PFI project. One issue for the Trust is then whether it has retained sufficient energy management expertise within the Trust, following TUPE, that it can continue to act as an informed client on energy issues. Some limited advice may be required here.

2.2 Annual Frequency Review

2.2.1 Key Performance Indicators

The PFI contract should have included a series of energy related key performance indicators (KPIs) such as annual energy consumption / square meter; type of energy use (gas, oil, electric); operating theatre hours of use etc that will be used to assess energy use during the life of the PFI. These need to be produced annually in a form that is auditable by the Trust.

2.2.2 Response to Legislative changes

Legislative, regulatory, or NHS guidance changes that require action relating to energy use (eg air change rates, Part L etc) will need to be implemented. The costs of these changes are likely to be carried by the Trust. Such changes need to be understood in advance so that they can be properly programmed in, and their impact in terms of energy use understood so that adjustments in shared savings schemes can be made as necessary.

2.2.3 Normalising actual energy use with baseline conditions

The contract should stipulate the way in which actual energy use will be compared to the baseline value for any given shared pain / gain scheme, and this should be followed. The advisor's role here should be verify the data, and to assist the Trust in discussions with the ProjectCo on any "grey areas" in the contract.

2.2.4 Performance feedback – relationship between ProjectCo operator and Trust

The Trust should be encouraged to provide open feedback between the Trust and the ProjectCo on energy related issues. Clearly energy consumption should be an issue for both the ProjectCo and the Trust.

2.2.5 Training / education

Education and training of Trust staff is an on-going issue – requirements need to be spelt out in the contract, and implemented.

2.3 2+ Year Frequency Review

2.3.1 Review of payment mechanism. Is the shared pain/gain scheme working?

Some contracts stipulate a formal review of any shared pain / gain scheme at regular intervals (five years being seen by some as a reasonable period by some). There is a balance to be struck within the wording of the contract that allows such a review – if the pain / gain scheme review needs to be mutually agreed, what will happen if this is not possible? Where such a pain / gain scheme is reviewed there is a need to ensure that the energy advisor ensures that the Trust's requirements for energy efficiency are met. Issues that may be included in the review are:

- The mechanism for comparing energy use against the baseline

- The development of a new baseline in the light of eg an expansion of the hospital
- Mechanisms for dealing with increased use of small power

2.3.2 Equipment renewal/ replacement programme

Where equipment is due for renewal or replacement the objective should be to ensure that an energy efficient alternative is procured. This may not necessarily lead to an increase in capital costs, but there may be a need to instigate a mechanism that allows any additional capital expenditure to be recouped by the ProjectCo from savings made by the Trust in running costs.

2.3.3 Formal energy audit to review performance

There may be a need for an energy audit at, say, five year intervals to review the energy performance of the site, and identify areas where the Trust and ProjectCo can improve the energy efficiency of the site. Clearly the audit needs to be undertaken in the light of the PFI contract and associated payment mechanism, and recommendations reflect the relative responsibilities for the two parties. Depending on the Trust / ProjectCo relationship the energy audit may be funded by either party, or by both.

2.3.4 Review of opportunities for new, more energy efficient equipment

Where equipment needs to be replaced (eg fans, pumps, lights), or where there is an economic justification of the installation of new services (eg photovoltaics at some point in the future), there is a need to evaluate the different options. If there is a formal shared pain / gain scheme this may be worded to encourage the investment in energy efficient equipment. Alternatively there will need to be negotiations with the ProjectCo on an ad-hoc basis, and failing agreement with the ProjectCo the normal mechanisms associated with alternative capital investment apply. It will be the energy advisors role to assist with the assessments of these different options, and their successful implementation.

Shared Savings Scheme for the purchase of new equipment. Inevitably new mechanical and electrical equipment will need to be purchased to ensure the maintenance of the building, part of this will be replacement, though there may also be opportunities where the introduction of new technology will reduce the payback period of new equipment such that it becomes a worthwhile investment for both the Trust and ProjectCo. The key is who finds the capital investment, and how running cost savings are assessed and distributed. One option is to develop some form of shared savings scheme with the ProjectCo whereby the ProjectCo make an additional investment in capital beyond expectations, and the Trust provides an incentive by way of sharing the rewards associated with the measure (reduced energy use). Care is required in terms of developing such a scheme as the additional capital costs and actual energy savings need to be carefully evaluated to be fair to both the Trust and the ProjectCo.

When purchasing new equipment the ProjectCo should be required to consider and demonstrate the following.

- Whole life cost of the equipment
- Net Present Value is calculated
- Ensure that Enhanced Capital Allowance is achieved, where possible.

Variation to PFI contract. Due to the timescales involved in PFI projects it is likely that variations to the contract will be necessary. The Trust should be aware of the cost implications of employing the necessary legal and financial analysts when doing so. In practice there is a degree of "horse trading" that goes on when a contract is varied, and it is sometimes possible to gain concessions on energy efficiency issues from the ProjectCo as part of what might be negotiations regarding non energy issues. Clearly this requires that the Trust recognises its own energy efficiency priorities.

Independent Review. As a result of energy monitoring and reporting, variance in the designed energy consumption compared with the actual energy consumption may be uncovered. There may be scope or the requirement for introducing an independent 3rd party to review energy consumption and management and to make recommendations on what may be altered to improve consumption. The ProjectCo should be made aware of the fact that this 3rd party could be engaged at any stage of the project.

3. Glossary

KPI – Key Performance Indicators
TUPE - Transfer Of Undertakings (Protection Of Employment) Regulations 1981 (TUPE)

4. Sources of information

CIBSE TM23: 2000; Testing Buildings for Air Leakage

CIBSE Commissioning Codes*
- CCA - Air Distribution Systems (1996)
- CCB – Boiler Plant (1975)
- CCC – Automatic Controls (2001)
- CCR – Refrigeration Systems (1991)
- CCW – Water Distribution Systems (2003)
- CCL – Lighting (2003)
- CCM – Commissioning Management (2003)

BSRIA Commissioning Guides*
- AG 1/91 - Commissioning of VAV systems in Buildings
- AG 20/95 – Commissioning of Pipework Systems
- TM 1/88 – Commissioning HVAC Systems
- AG 3/89.3 – Commissioning of Air Systems in Buildings
- AG 1/2201 – Pre commissioning cleaning of pipework systems
- AG 2/89.2 – Commissioning of Water Systems in Buildings
- AG 5/2002 – Commissioning Management

* The above are believed to be current at the time of writing but such guidance is always under review. Contract documentation should place the responsibility for identifying current versions of the above on the contractors on all cases

5. "Mobilisation and Operation" Checklist

The checklist provided on the following pages lists the issues that should be considered –and where applicable implemented –during the Mobilisation and Operation stage of the PFI process. This stage of the process is key for the Trust and ProjectCo to manage, occupy and operate the building in an energy efficient manner, whilst ensuring that project aspirations set at the start of the process have been realised.

Module 5 –" Mobilisation and Operation", Hospitals

	Check	Requirement	Output	Requirement Met	Required Action
1	Check that post occupancy tests have been conducted	Post occupancy tests to include monitoring and logging of: Internal and external temperatures; Controls algorithms; Optimisers; Pump/boiler/chiller on/off times; Set points; Valve/damper/VSD settings.	Results of monitoring to be made available, check that the test results are the same as in the detailed design.		
2	TUPE	Fallowing the transfer of staff to the ProjectCo, has the Trust retained sufficient expertise to act as an informed client on energy matters?	Assessment of capability / gap analysis.		
3	Energy – Actual vs Design	Is actual consumption in line with design expectations – if not the contract should require remedial measures or penalty clauses if fault lies with the ProjectCo	Trust energy advisor review of actual v design energy use, and reasons for any discrepancies. May involve discussions with ProjectCo. Successful resolution of differences.		
4a	Energy Baseline – for shared pain / gain savings scheme (if in place)	On basis of "bedding in" period ensure that an acceptable energy baseline is accepted by ProjectCo / Trust as the basis of a shared pain / gain scheme.	Energy baseline produced, with clear mechanism for reviewing actual energy consumption over coming year in terms of eg climate variations.		
4b	Conduct energy audit once the building is fully occupied in support of baseline calculation if needed.	Energy audit may be undertaken (Good Practice Guidance available) in support of the above.	Action in support of calculation of the energy baseline calculation. Specific energy efficiency measures to be implemented.		
5	Energy management/energy management matrix considered.	Energy use well managed with Trust and ProjectCo recognising their own responsibilities.	Review of energy management matrix, and associated development of action plan and its implementation.		
6	Energy information procedures / training	Established reporting mechanisms implemented for the ProjectCo to feed back on energy information [and other sustainability indicators]. Training of staff being undertaken on the use of hospital facilities.	Detailed reporting mechanism, criteria to be included and format to be agreed. Training undertaken.		
7	Energy [and environmental] policy	A policy should be developed and adopted by Trust and ProjectCo.	Policy approved and adopted. Requires clear associated KPIs.		
8	System is in place that energy audits are	Energy audits to be undertaken every 3-5	Frequency or occurrence of energy audits		

Module 5 –" Mobilisation and Operation", Hospitals

	Check	Requirement	Output	Requirement Met	Required Action
	conducted on a regular basis	years or when there is a major change in the operation or function of the building.	are in place.		
Annual Frequency Review					
9	KPIs	Ensure all KPIs included in the contract are being reported on and validated if necessary.	Validification of KPIs		
10	Compare actual energy data against baseline if a shared pain / gain scheme is in place.	Assess the building performance against energy baseline for the building, advising client on how to negotiate with the ProjectCo in the light of variations from assumptions associated with the baseline, and the requirements of the shared pain / gain scheme.	If target is not being met, investigation into where the differences occur must be made by Trust and ProjectCo. Encourage remedial measure. Negotiation of any revised baseline in the light of changes in the Trust – eg change in use of facility.		
11	Regular review of energy data	Established procedure in place to regularly review energy consumption data with target.	Data review carried out against energy target and consumption. Must also include a review of the assumptions made at the target setting and design stages.		
12	Re-commissioning is undertaken.	Encourage Trust to require re-commissioning of building services if performance begins to drift.	Necessary adjustments are made to the controls.		
13	Benchmarks	How is the Trust performing relative to peers, and what potential is there to improve energy performance? Liaise with NHS Estates and others if necessary to ensure that the energy consumption of the Trust is compared to comparable Trusts elsewhere. Identify remedial measures if consumption is excessive.	Realistic benchmark analysis with participation of ProjectCo.		
2 Year+ Frequency Review					
14	Review of Payment Mechanism (if included in PFI Contract)	Contribute to formal review of payment mechanism – client advisor – if the shared pain / gain scheme working. Also consider implementation of a shared pain / gain scheme if one does not already exist.	Formal review of shared pain / gain scheme. Negotiation of pain / gain scheme – including the introduction of energy efficiency measures		
15	Energy Audit	In support of above, and to identify cost effective energy efficiency measures that could be implemented, and the discussion with Trust / ProjectCo of suitable financing.	Audit recommendations implemented.		

Module 5 –" Mobilisation and Operation", Hospitals

	Check	Requirement	Output	Requirement Met	Required Action
16	Variation in contract	Procedure in place for dealing with variations in contract specifically with regards to energy and broader sustainability issues. Should review eg the payment mechanism (depends on contract) should it be clear that the various contract clauses / mechanisms are not resulting in an energy efficient approach on the part of the ProjectCo, or if there has been a material change in eg environmental standards due to revised NHS guidance or a change in use etc.	Significance of variation to be ascertained and reported. Appropriate alterations to the contract should be made.		
17	Project partnership	Ensure that appropriate mechanisms and reporting structures are in place from outset of mobilisation and operation. Review energy management matrix, and identify issues for both parties. Ensure long term commitments from ProjectCo to renew / replace equipment are being met.	Check that reporting structures and communication procedures are set up and working effectively. Actions arising from review of energy management matrix. Ensure ProjectCo has met long term commitments.		

Appendix A Energy Management Matrix (Source: Good Practice Guide 186)

Level	Energy Policy	Organising	Motivation	Information systems	Marketing	Investment
4	Energy policy, action plan and regular review have commitment of top management as part of an environmental strategy	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive system sets targets, monitors consumption, identifies faults, quantifies savings and provides budget tracking.	Marketing the value of energy efficiency and the performance of energy management both within the organisation and outside it.	Positive discrimination in favour of 'green' schemes with detailed investment appraisal of all new-build and refurbishment opportunities.
3	Formal energy policy, but no active commitment from top management.	Energy manager accountable to energy committee representing all users, chaired by a member of the managing board.	Energy committee used as main channel together with direct contact with major users.	Monitoring &Targeting reports for individual premises based on sub-metering, but savings not reported effectively to users.	Programme of staff awareness and regular publicity campaigns.	Same pay back criteria employed as for all other investment.
2	Un-adopted energy policy set by energy manager or senior departmental manager.	Energy manager in post, reporting to ad-hoc committee, but line management and authority are unclear.	Contact with major users through ad-hoc committee chaired by senior departmental manager.	Monitoring and targeting reports based on supply meter data. Energy unit has ad-hoc involvement in budget setting.	Some ad-hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten set of guidelines	Energy management is the part-time responsibility of someone with limited authority or influence	Informal contacts between engineer and a few users.	Cost reporting based on invoice data. Engineer compiles reports for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low cost measures taken.
0	No explicit policy	No energy management or any formal delegation of responsibility for energy consumption	No contact with users.	No information system. No accounting for energy consumption.	No promotion of energy efficiency.	No investment in increasing energy efficiency in premises.

BUILDING FOR HEALTH

SUSTAINABLE PFI PROCUREMENT IN THE NHS – REGENERATION AND COMMUNITY INVOLVEMENT

Major investments in NHS infrastructure have a commensurate impact on the local community – as well as providing new or refurbished, fit for purpose facilities for patients and staff, the economic impact on the local area can be significant. As well as local suppliers providing goods and services throughout a building's life, local people are employed in a variety of roles in the facility.

There is also an opportunity to provide local engagement in the planning and implementation of NHS investments.

The following section provides some sample clauses which can be used in PFI-type contracts to maximise the opportunities for local regeneration.

REGENERATION AND COMMUNITY INVOLVEMENT

INTRODUCTION

Fully integrated in the Government's Sustainable Development strategy, regeneration initiatives have been, and continue to be, successfully set up and maintained throughout the UK, alleviating poverty, a key cause of ill health. Given the size of PFI projects, and the huge positive impact they can make on local regeneration, Trusts increasingly find themselves within the scope or area of local regeneration activities. Trusts have an opportunity to positively impact on the communities in which they operate through active participation in local regeneration partnerships. Further, as Trusts are and have consistently been perceived as key members of the communities in which they reside, Trusts have the opportunity to engage and positively influence their communities, even where formal regeneration activities have not been undertaken.

The procurement and operation of new facilities offer a wealth of social, regeneration and community engagement, opportunities which are best seized when addressed at the earlier stages of the PFI procurement process. Ideally, Trusts should initially set and clearly define what their intentions and objectives are (e.g. through individual and local policies or wider strategies) before the PFI begins, so that the PFI can become an effective implementation mechanism of social initiatives, including regeneration and community engagement. Key themes and objectives (e.g. "proactively engaging the local community") may be developed which should be integrated at all stages of the PFI procurement process. Trusts should be mindful that those themes and objectives are not diluted, overlooked or negotiated out of the final agreement by bidders.

The following clauses have been identified from experience as illustrative of the type of clauses that may be included in PFI contracts, they are not exhaustive, and Trusts should be aware that "best practice" in this area changes rapidly. The clauses detail what Trusts may require of Project Co with regard to contributing to existing regeneration and community initiatives and, where appropriate initiating the development of new initiatives. The clauses intend to ensure that local regeneration and community involvement activities (often deemed secondary to construction / operation activities) are translated into concrete, detailed, robust and binding requirements of the contract; so that Project Co are incentivised to allocate adequate resources to addressing these issues.

While it is deemed that regeneration and community engagement issues should initially be tackled through Service Level Specification clauses (see below), Trusts may wish to incorporate these issues in other contract documents, and / or through formal reporting requirements, so as to provide a further incentive for Project Co to address the issues at stakes. Note that most large PFI contractors are increasingly aware of the impact that Corporate Social Responsibility (CSR) track record has on market sentiment.

	1. Required Outcome
	1.1 Project Co will use its position to make an active contribution to the development and delivery of wider social and economic regeneration strategies and activities being promoted within the area by fully engaging with regeneration networks and by actively seeking out and exploiting opportunities for developing strategic alliances.
	1.2 Project Co will ensure that neighbourhoods, communities and residents are fully engaged in the development of its work and are encouraged to contribute fully to the effective delivery of its services. In particular, Project Co will work closely with the public and voluntary sectors to develop consultation and communication processes which avoid duplication and build on established networks.
	2. Scope
	In contributing to the broader local regeneration agenda, Project Co will undertake to:
Details of on-going regional and local regeneration activities may be obtained from the Regional Development Agency or local Council.	2.1 Carry out regular research and analysis of local regeneration activities and opportunities as part of a sustainable development agenda and to establish an understanding of the key regeneration issues and drivers.
	2.2 Contribute to the development of strategic regeneration initiatives by fully participating in relevant regeneration fora.
Further information on Intermediate Labour Market may be obtained from: www.jrf.org.uk/knowledge/findings/socialpolicy/970.asp www.jobcentreplus.gov.uk/cms.asp?TextOnly=True&Page=/Home/Partners/EuropeanSocialFund/1731	2.3 Focus specifically on the creation of Intermediate Labour Market and training opportunities by working closely with local providers and by developing a supply chain charter and service agreements which will promote the use of local labour wherever possible.
	2.4 Maximise third party development within facilities, including social, community and commercial activities, by actively evaluating and promoting opportunities and by developing appropriate models of third party delivery.
	2.5 Develop partnerships with key agencies within the public and voluntary sectors in order to identify key issues and to assess the potential benefits arising from Project Co involvement.
	2.6 Where appropriate, engage with partners in the direct delivery of social and economic regeneration programmes.
The London Benchmarking Group model (a social impact assessment method) may be considered for use. Further information at www.lb-online.net	2.7 Evaluate on a regular basis the achievements of Project Co's involvement in such programmes, both in terms of Project Co core business and in the context of local impact.
	In terms of promoting and sustaining community involvement, Project Co will undertake to:

	2.8 Work closely with key partners to develop and maintain agreed community communications and consultation protocols.
	2.9 Establish and maintain monitoring systems which will capture residents' views in order to inform and enhance Project Co's work.
	2.10 Provide regular feedback to residents regarding the impact of community views on the work of Project Co.
	2.11 Commit to keeping local communities regularly informed about the work of Project Co in ways which are accessible and culturally sensitive.
	2.12 Develop and build relationships with local community organisations and the wider voluntary sector to identify common areas of interest and action.
	2.13 Engage with local residents through the use of community advisory fora, either by utilising existing structures or by establishing new arrangements.
	2.14 Attempt, as far as is possible, to reflect local need and demand through the accommodation of relevant third party activities in facility.
Project Co shall consult with the Trust and obtain formal Trust approval of the suggested Social Regeneration and Community Engagement Plan prior to implementation of the Plan.	2.15 Project Co will capture these ambitions through the production of a Social Regeneration and Community Engagement Plan, which will set out its overall strategy, establish specific goals and targets and which will be subject to regular and systematic review and revision.
The Trust should investigate and, where relevant, negotiate with Project Co opportunities to incorporate performance requirements in the Payment Mechanism. Linking performance requirements to the Payment Mechanism, or to a penalty clause system, should further incentivise Project Co to address regeneration and community issues fully, providing such a link can be identified.	**3. Performance Requirements**
	3.1 The production, implementation and regular review of a Social Regeneration and Community Engagement Plan that reflects the scope of Project Co's activities as set out above.
	3.2 The establishment of Project Co as a full participant in the development of wider social and economic regeneration strategies within the area.
	3.3 The establishment of Project Co as a major provider of and catalyst for the development of Intermediate Labour Market and training opportunities relevant to its work.
	3.4 The development of agreements with the Project Co supply chain that will emphasise the use of local labour where possible and appropriate.
	3.5 The development of a range of planning and delivery partnerships with the public, commercial and voluntary

	sectors that further the work of Project Co with the broader regeneration context.
	3.6 The creation of collaborative methods of community consultation and communication in partnership with key public sector agencies.
	3.7 The development of consultative arrangements with the local voluntary network and neighbourhood community organisations.
	3.8 The establishment and maintenance of centre specific community advisory fora to enable local people to engage in active dialogue with Project Co on a regular and consistent basis.

NOTES

1 – The above clauses are generic and, if included in the PFI contract, Trusts should aim to derive hard Key Performance Indicators (KPIs) from these clauses, so that Project Co's progress on meeting the clauses' aims can be measured.

2 – Trusts should ensure that Project Co are contractually bound to regularly report progress and demonstrate how the requirements of the above generic clauses are being complied with. Where feasible, Trusts should negotiate and regularly review targets that are linked to the KPIs developed above to monitor Project Co's progress on social initiatives.

3 – Trusts should be mindful that the social clauses and KPIs incorporated in the PFI contract are in line with UK and European legislation related to employment practices.

BUILDING FOR HEALTH

GUIDANCE ON SUSTAINABLE TECHNOLOGIES

This section highlights a selection of technologies which can substantially enhance the sustainability of a major investment. The description of each technology also includes details of suppliers, case studies, costs and potential sources of grants which may be available to assist the installation of these initiatives.

Technologies included are:

- Photovoltaics;
- Solar Thermal;
- Ground cooling;
- Wood fuelled boilers;
- Green electricity;
- Wind;
- Combined heat and power;
- Heat pumps;
- Fuel cells;
- Insulation;
- Daylighting;
- Solar Ventilation Preheating, and;
- Building Management Systems.

Grid Connected Photovoltaics (PV)

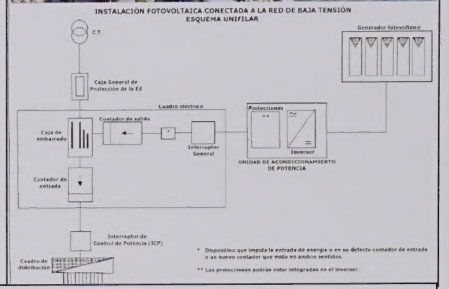
Description: Photovoltaic systems convert energy from the sun into electricity due to the potential difference caused when light hits semi-conductor cells. There are a number of different types of PV cell (some which work better than others in cloudy UK conditions) and come in a range of formats including roof tiles, glass laminates, shingles and bolt on modules.

A general PV installation has the following elements:

- PV modules (plus support structure): Their efficiency depends on the type of material, the local irradiation (which depends on the latitude and local climate), the orientation and inclination of the module and if it is mobile or fixed. It can be installed on the ground (if protected from vandalism and shading devices), on the building façade or on the roof.
- Inverter: This is required to convert the direct current produced into the alternating current required by the National Grid. It must be located close to the energy generator to reduce energy losses
- Elements for grid connection (a 2 way meter)

Practical issues/advantages:

- There is currently DTI funding available for grid connected PVs for homes, public and commercial buildings (see 'Grants' for more details)
- No emissions (therefore helps to meet national and regional carbon dioxide reduction targets)
- Inexhaustible source of energy, although it is intermittent with knock on effects on output
- Easy and light to install, negligible maintenance (no moving parts)
- Avoidance of climate change levy
- Reluctance of some utilities to connect to small scale embedded generators, although this is improving
- High capital cost and poor returns on the value of electricity produced
- Lack of standards and shortage of installers although this situation will improve with the market stimulation due to DTI grants.



Available Software: PVSyst; Pvsolv

Suppliers/installers: www.greenelectricity.co.uk; www.solarcentury.co.uk, www.pvsystems.co.uk, www.bpsolar.com, http://www.est.co.uk/solar/installers.doc

Applicable Legislation:

- Permission is need from the local Distribution Operator (DNO) to connect to the electricity grid and approved equipment for the UK must be used. The electricity being fed into the network must also comply with mains power quality requirements. Guidance is provided in Engineering Recommendation G77/1
- An annex to Planning Policy Guide 22 for issues relating to PVs (www.planning.odpm.gov.uk/ppg/ppg22/annex/index.htm)

For more information

www.pv-uk.co.uk;
www.dti.gov.uk/renewables
www.practicalhelp.org.uk/casestudies/pvs/pv_bn.doc

Bibliography

Solar ElectriCity Guide (www.esd.co.uk); DTI series 'Photovoltaics in Buildings' including a design guide; a testing, commissioning and monitoring guide and an installation guide.; Universal Technical Standard for solar home systems", Thermie B SUP 995-96, EC-DGXVII, 1998 (www.ies-def.upm.es/ies/eng/groups/system/project/CESIS-PV/toc.asp);

Rules of thumb:

100 kWh/m^2.year
750kWh/kWp/yr depending on cell efficiency
orient -+30° of S for best

Benchmark prices:

DTI trials: av. £5000 – 10000 kWp,

Case studies: DTI field trials – see Photovoltaics in Buildings Domestic Field trial newsletters 1 and 2, www.dti.gov.uk/renewable

Grants: www.solargrants.org.uk (up to 40% for commercial, up to 50% for private domestic and up to 65% for public sector)

Solar Thermal

Description:

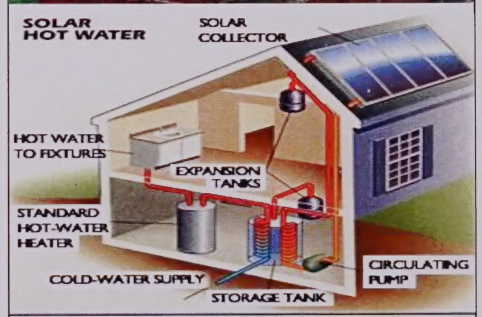
Solar thermal systems convert solar radiation to thermal energy. They are mostly used for the production of domestic hot water and for swimming pools in the UK but they can also be effective for commercial hot water and could be used for preheat for space heating (although this is less usual due to seasonality.)

It is estimated that the UK receives over 1000 kilowatt hours of solar energy per square metre every year. A solar domestic hot water system could supply up to 50% of the hot water requirements of an average house. During the summer, the system can supply almost all the hot water needed, with water temperatures from 70 to 85°C. Even in winter, the system can reduce water heating costs by around 20%. As a standard solar system (consisting of solar collectors, an optional pre-heat tank, a pump, a control unit, connecting pipes and the normal hot water tank) in the UK cannot provide enough heat to supply hot water at the desired temperature throughout the year, a conventional heat source is required to supplement it.

A 1995 ETSU report estimated 42,000 systems (mainly domestic) in the UK. This figure is now estimated to be 200,000 aided by innovative local authorities offering discounted systems and grants.

Practical issues/advantages:

- Mostly used for the production of hot water for households and small hotels.
- Different collector technologies: evacuated tube systems that use metal plate collectors running through vacuum tubes, the vacuum acting as insulation preventing heat loss; flat plate systems which use a metal absorber plate coated with low emissivity back paint.
- .Need for unshaded surfaces (normally roofs), with correct orientation and slope (south facing, 45°) Systems can be roof integrated or bolted on top of an existing roof finish.
- Correct sizing for the production and storage of the hot water (approx. 1m^2 per person in the household)



Suppliers

Solar Trade Association members: www.solartradeassociation.org.uk (details of member suppliers and installers)

Available Software: TRANSYS, TRASOL

Rules of thumb:

400 - 700 kWh/m^2 year, reduction of 250 – 1300kgCO_2 /m^2 year (depending on fuel type being replaced, efficiency of system and water load)

For more information:

www.dti.gov.uk/renewable
www.etsu.com
www.greenenergy.co.uk

Bibliography / Design Guides:

Active Solar Heating System Peformance and Data Review, www.dti.gov.uk/renewables

Applicable Legislation:

5% VAT on system if professionally installed, 17.5% VAT if DIY

Benchmark prices:

£2000-£3000 installed for a typical installation (4m^2)

Case Studies: www.caddet-re.org, www.dti.gov.uk/renewables
http://www.practicalhelp.org.uk/content/case_housing5.htm

Grants: Solar water heating is eligible for grants under the Energy Efficiency Commitment - contact energy suppliers or Energy Efficiency Advice Centres for details; upcoming DTI Community and Household Renewables Grants (www.dti.gov.uk/renewables)

Ground Cooling

Description

The earth can serve in many climates as a heating or cooling source. It has a high thermal capacity that keeps the soil temperature (below a certain depth) lower than the ambient air temperature during summer or higher during winter. It is estimated that a few meters below the surface, the earth temperature remains constant throughout the year. In temperate regions, the temperature of the soil at depth of 2-3 meters can be low enough during summer to serve as a cooling source.

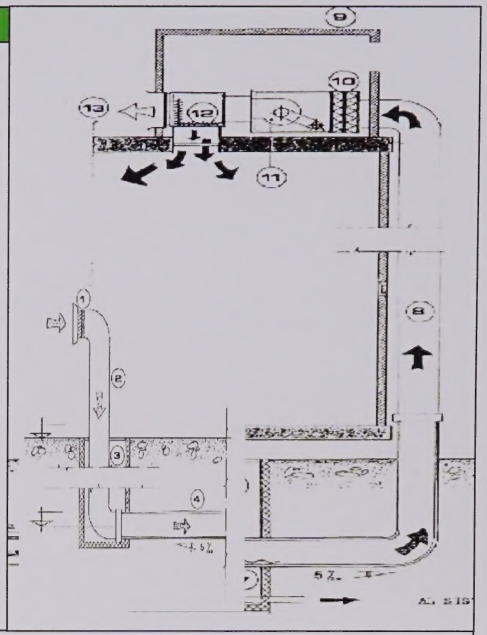
Room-comfort can therefore be provided in summertime by coupling mechanical ventilation systems with passive ground cooling of the inlet air. The passive ground cooling system is by steel or PVC piping 10-60m in length and buried at a depth of 2-4 m. The pipes must be connected at one side with an inlet hatch, and on the other with the ventilation unit of buildings. The piping, placed on a bed of sand must be completely sealed and protected against water infiltration and corrosion; furthermore, the piping is equipped with filters for the inlet air, drainage system for moisture condensation and a counter flow cleaning system.

Ground cooling can be recommended for:

- Avoiding electricity consumption
- Improving indoor thermal comfort
- Healthy cooling.

Application field: It can be applied to any climate, but it particularly applicable for hot and dry climates. It could reduce future electricity consumption for air conditioning in southern European countries.

Practical Issues: The size of the piping and the air flow rates are selected using formulas which can optimise the system. The piping should be installed during the construction of foundations, underground parkings or the intervention of green areas, in order to minimise the installation costs.



Available Software: Ground (SOFTECH)

Rules of thumb:

- 2-6 °C below outdoor temperature
- underground tubes: 40 meters length; 30-40 cm diameter
- Soil type has a limited influence on thermal performance (e.g. +/- 10%, with wet and heavy soils performing better than light, dry soils.

Applicable Legislation:
Consent from local water authorities

Benchmark prices:
10 €/m2 building
+ ventilation equipment

Suppliers and installers : www.heatpumpnet.org.uk; www.clima-gas.co.uk www.clivetaircon.co.uk; www.kensaengineering.com/; www.earthenergy.co.uk; www.emis-ice.co.uk

For more information:
www.feta.co.uk/hpa;
www.heatpumpnet.org.uk
www.heatpumps.co.uk
www.earthenergy.co.uk

Bibliography / Design Guides:
Ventilation and air conditioning CIBSE B2
Low energy cooling – technologies selection and early design guidance, IEA Energy Conservation in Buildings and Community Systems programme

Case Studies: europa.eu.int/comm/energy_transport/atlas/home.html, www.earthenergy.co.uk/eegrswel.html, www.nmgw.ac.uk/mwl/buildings/future/
EC DG-TREN Coolhouse Project - www.softech-team.it/coolhouse/index.htm

Grants: None

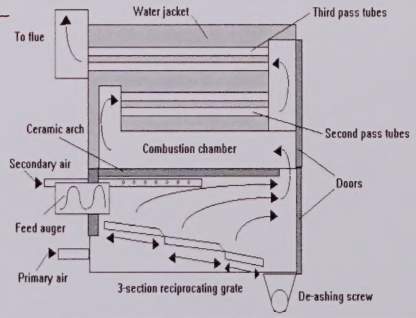
Wood fuelled boilers

Description/Application field:

Wood fuelled boilers can replace the conventional gas boilers, though they may be slightly larger. They have hopper feeding systems requiring one bag of wood pellets to be put unopened into the hopper per day, with a screw feed to the burner. Most systems are wet (radiators and convectors), but warm air systems are also possible. Where new buildings are designed, attention should be paid to lowering the heat and steadying load (possibly including the use of under-floor heating). Heating of larger homes and commercial premises such as offices, schools and factories is feasible. A range of boiler equipment is available from 15 kW upwards.

Practical Issues:

- Ash removal every three months
- Size of fuel storage limiting factor for boiler output
- Fuel particle size and moisture must be consistent
- Fuel must be fairly dry (preferably <25 % moisture)
- Transport/delivery and storage of fuel must be considered when designing and installing systems
- Regular (and preferably sustainable) supply of fuel.



Available Software:

Applicable Legislation:
Clean Air Act 1993

Rules of thumb:
1 m3 storage:24hrs
18kW output
(fuel input: 6 kg/hr(25kW)

Benchmark prizes:
Approx. double cost of a gas boiler.
Fuel cost: 0,028 € p/kWh

Suppliers
List of suppliers: www.greenenergy.org.uk/suppliers/Trade%20Boilers.pdf
www.woodheat.co.uk

For more information
www.britishbiogen.co.uk

Bibliography / Design Guides
British biogen Good Practice Guidelines for Wood Fuel from Forestry and Aboriculture

Case Studies: www.britishbiogen.co.uk/bioenergy/heating/casestudy.htm, www.caddet-re.org, www.dti.gov.uk/renewable

Grants: www.britishbiogen.co.uk, www.dti.org.uk/energy

Green Electricity

Description:

Green energy is loosely defined as energy from renewable or sustainable sources, such as wind, solar, biomass and hydro power. Waste-to-energy projects are also usually considered renewable because of the large biomass content in the fuel. At present, green electricity is the only form of green energy readily available, however 'green gas' and 'green heat' may be available in the future.

Objectives: Energy users (domestic and non-domestic), can purchase green electricity to help them to meet their environmental targets and/or show the public that they are acting in a responsible manner. Demand for green electricity will stimulate electricity suppliers to fund and/or develop renewable supplies.

Application field: With increasingly liberalised energy markets many countries are adopting new schemes which give consumers greater choice, including the opportunity to purchase green energy.

Practical Issues:

- Electricity suppliers may charge a premium rate for green electricity.
- Two basic types of green electricity tariff are available:
  - **Renewable supply** tariffs, guarantee that for every unit of electricity used, the corresponding amount of renewable electricity will be generated, balanced over a one year period
  - **Renewable fund** (or **Eco-fund**) tariffs, feed an investment fund that is to be used solely to invest in new renewable energy generation capacity.
- Accreditation: Electrolabel is an EC-funded project to develop and maintain a standard for green electricity accreditation harmonised across the EU. This will give consumers confidence that electricity they purchase is from environmentally friendly sources. Future Energy is the UK accreditation scheme.
- Green electricity is exempt from the climate change levy, a 0.43p/kWh tariff on business energy

GREEN ELECTRICITY

Renewable
every unit of electricity bought by a consumer is generated from a renewable energy source.

Eco-Funds
additional premium is invested in new renewable energy projects.

RECS
Renewable Energy Certificate System

Available Software:

(For the UK, tariffs can be checked on www.greenprices.com)

Suppliers (UK) :

Ecotricity: www.ecotricity.co.uk ; Unit(e) – www.unit-energy.co.uk
Most UK suppliers now have some form of green tariff. The above specialise in green supply.

Rules of Thumb: N/A

Applicable Legislation:

Renewables Obligation 2002 10% (18% in Scotland) of electricity must be renewable by 2010. Climate change levy – renewable energy is exempt

Benchmark prices:

Same price or a small premium on standard electricity prices. It may be exempt from the climate change levy depending on the source.

For more information:

www.greenprices.com, www.recs.org/
www.itcltd.com/electrolabel/
www.ukenergy.co.uk, www.est.org.uk
www.foe.co.uk (league of tariffs)

Bibliography / Design Guides:

Not applicable

Case Studies

see www.greenprices.com, www.practicalhelp.org.uk/content/case_add5.htm

Grants: Not applicable

Wind

Description/Objectives/Application field :
Wind turbines produce electricity by using the natural power of the wind to drive a generator. The UK has the largest potential wind energy resource in Europe with 33% of total European offshore potential yet currently gets less than 1% of its electricity from wind. Wind energy applications in the UK range from small battery charging applications producing a few hundred Watts of useful electricity remote from the electricity distribution network, 6kW turbines powering part of a school, to large wind farms producing megawatts of electricity at a comparable price to conventional power stations. Single turbines are available that can generate up to 2MW.

Practical issues:
•Siting of turbines – away from obstructions, ideally on a smooth hill top in the prevailing wind direction.
•Windiness of the proposed site – wind is an intermittant energy source however this isn't a problem for grid connected systems as the variable output often coincides with periods of peak electricity demand
•Wind is a widely available resource and is particularly suitable for island and rural areas.
•No emissions result from generation and embodied energy in the manufacture of the wind turbine itself is generally paid back within 6 months.
•Planning permission will be required for even a small turbine. Due to a general perception that wind turbines are noisy and an eyesore, planning permission can be hard to obtain although some local authorities are favourable and have even written special planning guidance for it.

Available Software:
Windspeed Database www.bwea.com/noabl/index.htm

Applicable Legislation:
Approval by the Department of Trade and Industry under Section 36 of the Electricity Act is required for all generating plant over 50 megawatts capacity.
Planning Policy Guidance (e.g. PPG22)and Supplementary guidance produced by local authorities

Grants: Offshore wind: www.dti.gov.uk,
Community wind projects: www.practicalhelp.org.uk/content/ip.htm

Suppliers:
Galeforce Wind Turbines (NI) Ltd. –www.galeforce.uk.com
Danish Wind Turbine Manufacturers –www.windpower.org/manuf.htm
Marlec –www.marlec.co.uk/company/company.htm
Proven World Friendly Technology –www.almac.co.uk/proven

For more information:
www.uk4wind.co.uk
www.windworks.ltd.uk

Bibliography / Design Guides: UK Best Practice Guidelines for Wind Energy Development; European Best Practice Guidelines for Wind Energy Development

Rules of thumb:
•Power available is a function of the cube of the wind speed.
•Up to 65m blades
•Turbine towers 25-75m
•Several kW to MW
•Operating range: 4-15m/s (min av. wind speed of 6m/s)

Benchmark prices:
2.88p/kWh
£750/kW installed capacity (2/3 is the cost of the turbine)
0.5p/kWh operational and maintenance costs.

Case Studies:
CADDET Renewable Emergy Infostore: www.caddet-re.org/infostore/index.php
EcoTech Centre, Ecotricity, Swaffam, Norfolk: www.ecotech.org.uk
British Wind Energy Association - www.bwea.com
EST Innovation Programme
www.practicalhelp.org.uk/casestudies/innovprog/swansea_cs.doc
DTI new and renewable energy: www.dti.gov.uk/renewables

Large-Scale CHP

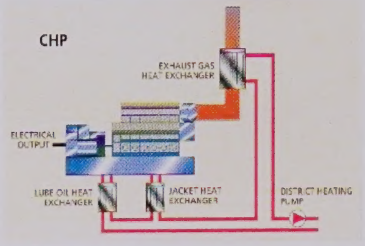
Description:
See General CHP page for overview of cogeneration / combined heat and power.
Large-scale CHP is where a large area, typically a housing estate, town centre or small town, is connected to a district (community) heating network. The heat for the network is provided primarily by CHP plant that generates both electricity and heat. The excess electricity (after the plant load has been met) is usually sold and exported into the national grid, while the heat is sold under contract to those connected to the network. It is possible to distribute and sell the electricity locally but there are both practical and legislative barriers to this – in the UK this requires a 'private wire' network.
Large-scale CHP can also be used for district cooling as well as heating increasing the viability by ensuring a load throughout the year. Cooling is generated by absorption chillers.

Application field:
Large scale CHP is most appropriate to consider when an urban area is being regenerated, or when masterplanning a new area. Where CHP serves a variety of users, this is likely to be more viable due to a more balanced and constant overall heat load.

Practical Issues:
•The distribution pipes for the heating network must be high quality to minimise leaks and losses and also must be highly insulated. They are quite expensive and can be expensive to lay, especially in retrofit situations.
•Properties must be accurately heat metered. This can be costly and require a lot of administration.
•The density of development is important, as the cost of the district heating network is substantial.
• Buildings attached to the network can reduce plant room space if they rely entirely on the CHP network. Boilers are replaced by a heat exchanger, saving much space.

Photo

Scheme



Available Software:

Suppliers:
Nedalo - www.nedalogroup.com/
Search CHPA directory: www.chpa.co.uk/direct.htm

Applicable Legislation:
UK Legislation: Clean Air Act, Utilities Bill.
Proposed EU directive on the promotion of cogeneration (under consultation)

For more information:
www.chpa.org.uk; www.cogen.org
www.caddet-ee.org

Bibliography / Design Guides:
GPG 234 – Guide to CHP and community heating

Rules of thumb:
For housing developments, a minimum density of 50 dwellings per hectare is required
Simultaneous heat and power demand for >4500 hrs/yr

Benchmark prices:
~ £600/kWe installed CHP plant (not including heat network)

Case Studies:
Woking Borough Council – Thameswey ESCO - www.chpa.co.uk/profiles/69.html
Southampton Community Network – www.southampton.gov.uk/geothermal/
Barkantine Combined Heat and Power Company - www.est.co.uk/pdf/es_case_study_004.pdf
Sheffield Heat and Power – www.shp.co.uk

Grants: Community Energy Programme, www.est.co.uk/communityenergy,
Details on enhanced capital allowances: www.eca.gov.uk

Heat pumps

Description

Heat pumps supply more energy than they consume, by extracting heat from their surroundings. Currently heat pump systems can supply as much as 4kW of heat output for just 1kW of energy input. Heat is transferred from outside air or from warm exhaust air. It can also be drawn from a water source such as river, ground or waste water. Heat from any of these sources is used to heat air or water for various heating needs.

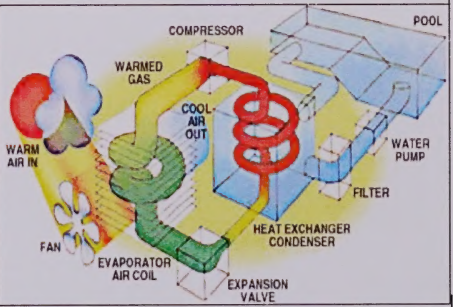
Heat pumps can be used for commercial space heating, process heating and domestic heating. Unlike other heating systems heat pumps can also be used for cooling. A heat pump works by driving a working fluid around a refrigeration circuit containing four elements; evaporator, compressor, condenser and expansion valve. The working fluid evaporates from liquid to gas as heat is absorbed from the heat source. Later in the cycle, the working fluid condenses to liquid as heat is released to where it is needed. A heat pump can be used for cooling with the addition of a reversing valve that reverses the direction of the working fluid and so the direction of the heat transfer. The central component of the heat pump is the compressor. This is usually driven by an electric motor, although gas engine driven compressors are also available.

Application field

Heat pumps can be used in various situations, provided that the surrounding temperature is sufficient for the system fluid to evaporate. It can be used in combination with seasonal storage or advanced ventilation systems.

Practical Issues:

- If it is a ground source heat pump, the ground coil can be expensive to lay
- The energy consumption of auxillary equipment (fans, pumps)
- The temperatures of the heat source and heat distribution system
- The climate - annual heating and cooling demand and maximum peak loads



Rules of thumb:

The ratio of energy-out to energy-in depends on the operating conditions and typically varies between 2 to 1 and 5 to 1.

Applicable Legislation

Groundwater protection legislation may be applicable

Available software:

www.heatpumpcentre.org/products/download/0203_dt.pdf) report on design tools

Benchmark prices:

(housing and utilities):
450-1350 €/kW
more than conventional

Suppliers

www.heatpumpnet.org.uk; www.clima-gas.co.uk www.clivetaircon.co.uk; www.kensaengineering.com/; www.earthenergy.co.uk; www.emis-ice.co.uk

For more information:

www.feta.co.uk/hpa;
www.earthenergy.co.uk
www.heatpumpnet.org.uk;

Bibliography / Design Guides

EEBBP GIR067/072 Heat Pumps in the UK – current status and activites/A monitoring report; GPG339 Doemstic Ground Source Heat Pumps: Design and installation of closed-loop systems

Case Studies:

www.caddet.org; www.heatpumpcentre.org/cases/home.htm
BSRIA Ground Source Heat Pumps – A Technology Review

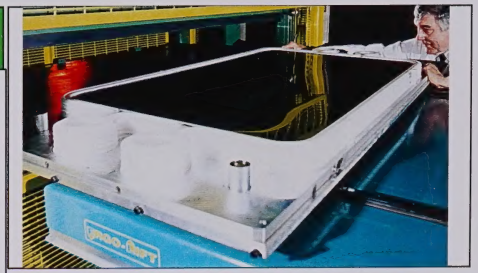
Grants: europa.eu.int, DTI community and household renewables grant programme, www.dti.gov.uk/energy

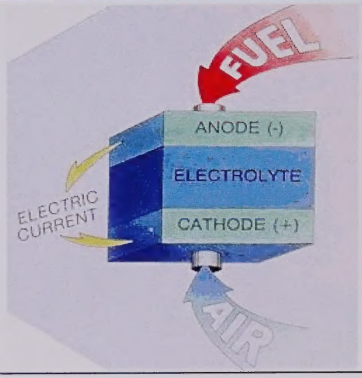
Fuel Cells

Description:
A fuel cell is an electrochemical battery. Fuel cells convert chemical energy directly into electricity by combining hydrogen and oxygen in a controlled reaction. They emit virtually no pollution as the products of this reaction are electricity, heat and water vapour. If the waste heat is used, up to 80% fuel efficiency can be achieved. There are a number of different types of fuel cell.

Application field:
Fuel cells can power a wide range of applications from a cellphone, to a motor vehicle, to a large building, to a district power supply. For buildings, fuel cells offer most promise in CHP applications (see CHP Summary Card). They can be used as a means of electricity storage by using cheap off-peak electricity to produce hydrogen by electrolysis, storing this for later use in the fuel cell to generate expensive, peak rate electricity.

Practical Issues:
- Fuel cells are inherently modular and can be expanded to suit different applications.
- The hydrogen fuel is produced by either electrolysis of water or 'reforming' a hydrocarbon fuel. Any harmful emissions are associated with the production of hydrogen rather than the operation of the fuel cell itself.
- If renewable electricity is used to power the electrolysis, a complete, cyclic and virtually non-polluting process can create both electricity and useable heat.
- Fuel cells are relatively small and compact, however the production & storage of hydrogen is an issue.
- The water that is produced by the fuel cell is pure, and could be sold as distilled water to industry.
- Fuel cells for stationary applications (e.g. CHP) are commercially available, however systems are generally at early stages of commercialisation and so projects have substantial technology risk. At present fuel cells are expensive and operation and maintenance costs are also high, however costs are declining rapidly.





Available Software:

Applicable Legislation: N/A

Rules of thumb:

Benchmark prices:
£100/kWe for residential CHP
£500/kWe for distributed power
£800/kWe for commercial scale CHP

Suppliers:
Regenesys (an Innogy company) - www.regenesys.com
Nuvera Fuel Cells (Italy) - www.nuverafuelcells.com/
Plug Power (USA) - www.plugpower.com

For more information:
www.fuelcells.org, www.efcf.com/
www.fuelcelltoday.com//www.matthey.com/environment/fuelcell/index.html,
www.dti.gov.uk/renewable/pdf/tech9.pdf

Bibliography / Design Guides:

Case Studies:
Thameswey ESCO, Woking –www.chpa.co.uk/profiles/69.html

Grants: The Carbon Trust: www.thecarbontrust.co.uk

Insulation

Description:
The energy consumption of buildings can be reduced by insulating both the building fabric (external and internal walls, floors, ceilings and lofts) and services (such as hot water tanks and pipework). The level of insulation required under buildings regulations is increasing in response to environmental pressures and occupant comfort standards. Traditional insulation materials are typically made of mineral or glass wool and plastic foams. There are also more sustainable products on the market such as recycled paper, sheep's wool and flax that tend to have lower embodied energy and do not use up fossil fuel supplies unlike plastic foams. These tend only to be suitable for lofts or timber framed 'breathing' constructions.

Practical issues:

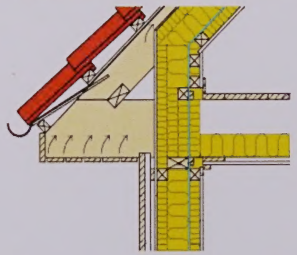
•Good insulation decreases energy use, running costs and carbon dioxide emissions.

•It is worth insulating above the required standard to stay ahead of ever tightening legislation. It is cheaper to insulate at the new build stage rather than retrofitting.

•Traditional insulation materials are cheap and have a long life. Renewable insulation materials are currently more expensive than their traditional equivalents. They have similar insulation qualities (e.g. to mineral wool) and can be more pleasant to install.

•The thermal mass of the building must also be included in an assessment of the energy consumption for heating in the building.

•If a building is well insulated and is air tight, adequate controllable ventilation must be provided to prevent condensation and mould growth, keep indoor pollutants at a low level, reduce odours etc.



Available Software:
ISOSPEC, NHER Autoevaluator, Regs Calc 2001

Suppliers:
Standard insulation - any builders merchants or DIY store
Renewable insulation, see report by Impetus Consulting
www.impetusconsult.co.uk/research.html

Applicable Legislation:
Part L1 (domestic) and Part L2 (non-domestic) building regulations
Part J Building standards regulations (Scotland)

For more information: Trade Associations
Timsa (thermal insulation): www.timsa.org.uk
Eurisol (mineral wool): www.eurisol.com
General insulation:
www.insulationassociation.org.uk
External cladding: www.inca-ltd.org.uk

Bibliography / Design Guides
Many best practice guides on
www.actionenergy.org.uk
e.g GPG293 External insulation systems for walls of dwellings

Rules of thumb:
The lower the K-value (thermal conductivity) the better.

Benchmark prices:
Mineral wool ~ x6 cheaper than Sheep's wool.
(3200x400x150mm ~ £4/m2)

Case Studies: See www.actionenergy.co.uk

Grants:
Domestic properties – contact energy suppliers regarding Energy Efficiency Commitment grants

Daylighting

Description: People prefer day-lit rooms to those that are predominately lit by electric lighting. Day-lighting can also bring significant advantages in cost savings, as the need for artificial lighting is reduced as well as the need for the cooling loads created by artificial lighting.
The amount of natural light brought into buildings depends on the:

- Geographical position and climatic conditions
- Type and size of window systems used
- Architectural parameters (geometrical data and reflectivities) of the building
- Characteristics of the adjacent built environment (obstructions, reflectivities)

Daylighting control strategies are divided into three categories:

- Components designed to control the direction of light beams falling on the glazed surfaces
- Components designed to reduce the amount of daylighting entering the building
- Components for glare control.

Application field: It can be applied to all types of building and building uses..

Practical Issues:

- Maximum allowable percentage of glassing as a percentage of the external walls surface according to national standards
- Energy savings during cooling period
- Electricity and CO2 emissions savings
- For the daylighting system to work well there must be good controls for the electric lighting (ideally linked to lux levels and to occupany) and motivation by the occupants to save energy. Electric lighting layout and control should reflect the availability of daylight (i.e. parallel to windows).
- Light pipes can be used to bring daylight into areas where daylight via window isn't accessible.

Available Software: DIALUX EUROPE, ADELINE RADIANCE, SUPERLITE, LIGHTSCAPE

Suppliers : Architects aware of daylighting issues; light pipes: www.monodraught.com, www.natralux.co.uk/lighting/light_pipes.htm, www.light-pipe.co.uk/ main.htm

Applicable Legislation:
BS 8206 lighting for buildings: Part 2: Code of Practice for day lighting.
Building regulations Part L limits glazing area to prevent heat loss and gives guidance on electric lighting controls.

Rules of thumb:
Good daylighting would save 10-15 W/m^2 of comparative electric load. Daylight factor within a space should be min. 2% (BREEAM) over 80% of the area.North light is good for daylighting

For more information
www.iea.org (Task 21- daylighting in buildings)
BRE. 'Designing buildings for daylight. Professional studies in British architectural practice'. BR 288. BRE, 1995.

Bibliography / Design Guides
CIBSE LG10 Daylighting and window design guide, EEBPp GPG245: Desktop guide to daylighting for architects; Building Research Establishment. 'Site layout planning for daylight and sunlight. A guide to good practice'. BR 209.

Case Studies: Daylighting performance of 60 buildings
http://www.unl.ac.uk/LEARN/port/1998/daymedia/web/marc/pdf/dayeuro1.pdf

Solar Ventilation Preheating

Description:

Solar ventilation preheating is an efficient way of reducing energy cost through the installation of a "solar wall" to heat air before it enters a building,. The system works by heating outside air with a south-facing solar collector—a dark-coloured wall made of sheet metal and perforated with tiny holes. Outdoor air is drawn through the holes and heated as it absorbs the wall's warmth. The warm air rises in the space between the solar wall and the building wall and is moved into the air-duct system, usually by means of a fan, to heat the building. Any additional heating needed at night or on cloudy days is supplied by the building's conventional heating system. During summer months, intake air bypasses the solar collector, preventing the air from being preheated. A solar ventilation preheating system is approximately 75% efficient, losing only minimal heat to the surrounding air. Solar preheating systems can also improve air circulation when used in conjunction with air delivery systems.

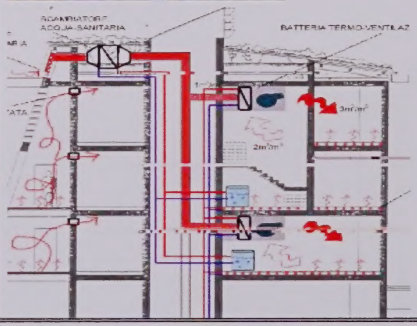
The simplest way to use solar energy for heating ventilation air is to use the existing roof surface (e.g. south facing slates or tiles) which are absorbing solar heat. In bright sunshine, dark coloured slates can be up to 40 degrees (C) warmer than the outdoor air and can heat the incoming air by up to 30degrees (C). Such a system does not need any solar panels, the existing roof does the job. A small fan (preferably powered by the sun) is needed to draw the warm air into a duct and deliver it to the building below through a ceiling mounted grille, normally in the hallway.

Application field: Ideal for commercial and industrial buildings with a large ventilation requirement..

Practical Issues:

•Buildings that benefit most are those with relatively large outside-air ventilation loads.

•The length of the building's heating season: the building should have a relatively long heating season, because solar ventilation preheating works well in relatively cold and sunny climates



Available Software: FCHART, Passive (SOFTECH), NES Office Design Tools

Suppliers: Suitably trained architect or consultant

Rules of thumb:

• The size of south-facing wall: the wall must have enough surface area to mount the collector in an aesthetically pleasing way. A rule of thumb is that 1 square foot of collector area will heat 4 to 10 cubic feet of air per minute.

For more information:

www.actionenergy.co.uk

Bibliography / Design Guides:

GPG290 Ventilation and cooling option appraisal – a client's guide

GIR59 Natural ventilation: good practice in the UK

Case Studies

europa.eu.int/comm/energy_transport/atlas/home.html

www.johngilbert.co.uk/pdf_files/livinginsun/10_Burdiehouse.pdf

www.johngilbert.co.uk/pdf_files/innovation/7_589_Dumbarton_road.pdf

Applicable legislation:

Building regulations Part L1, L2 (England & Wales)

Building standards Part J

Benchmark prices:

Minimal if designed in at an early stage.

Grants

None

Building Management Systems

Description:

Building Management Systems (BMS) automatically control a building or sites' resources though inter-connected sensor and control devices that can perform many security, comfort, communications and especially, energy saving applications. The complexity of the systems can range from simple, isolated systems up to the integrated management systems that control all the devices. They can be important tools for monitoring energy use and setting targets. The different modules available include:

•Communications system – all applications can be connected to this.

•Energy consumption meters which can be connected to the communication system or read directly.

•Heating – cooling regulation through use of thermostats, indoor/outdoor temperature sensors, opening sensors.

•Lighting regulation through use of presence sensors, lighting sensors or both.

•Load management device that can control electrical appliances to distribute electricity consumption avoiding consumption peaks.

•Time controls to take advantage of off-peak electricity tariffs and control heating systems etc in relation to normal occupancy.

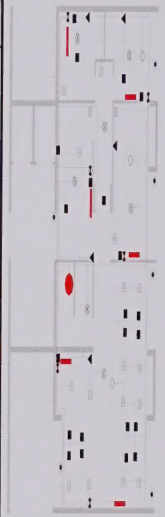
Application:

BMS scope is very wide – from small premises to large sites.

Practical Issues:

•For existing buildings, the installation might be more expensive because of additional electric wiring required in the walls. Nevertheless, the market is ready to provide wire-less for existing buildings.

•It is essential that all parts of the system are correctly commissioned and that individuals are correctly trained how to use all aspects of it.



Available software: Monitoring software to interface with BEMS (e.g. TEAM)

Suppliers: James and James online database of suppliers: www.ixi.com/suppands/edseeb/select company/455 119.html

For more information:

Bibliography / Design Guides:

Applicable Legislation: At this moment there is no legislation specific to B.M.S.

Case Studies:

GPCS390 Building management systems in multi-site commercial and industrial building www.actionenergy.co.uk/dynamic/document/GPCS/GPCS390.pdf

Other guides on www.actionenergy.co.uk include GPCS013 & GPCS021 Energy efficiency in offices

Rules of thumb: 10-30 % energy savings if correctly set up and operated

Benchmark prices:

Grants: N/A

BUILDING FOR HEALTH

APPENDIX – THE ORIGINAL BUILDING FOR HEALTH REPORT

The original Building for Health report was commissioned by the former London Regional Office of the NHS Executive in late 2000 and was published in April 2002.

The report identified the opportunities available to the NHS in embedding sustainability in major investment programmes and projects. It also contains a set of useful case studies and good practice.

The original report is appended to this document to provide a useful context to the work which has been undertaken subsequently.

SUMMARY

Building for Health

The "**Building for Health**" report demonstrates that it is:

- practical
- affordable
- timely and
- less risky

to fully incorporate the principles of sustainability into the current NHS capital spending programme in London.

Incorporation of these principles will mean that capital expenditure on the health service in London will most effectively contribute to the health, as well as the health care, of Londoners

The report presents:

- the case for sustainability, referring to the current policy environment
- Case Study examples showing how the principles of sustainability have already been addressed
- a review of the PFI process, showing how sustainability can be incorporated
- and examples of contractors, showing how they already appreciate the sustainability agenda

The report, and the work behind it, has been supported by: NHS London Region; AECOM/Maunsell plc; Environment Agency; Forum for the Future; The Natural Step; King's Fund; London First; Dr Robin Stott of Lewisham Hospital; and conducted by the consultancy Brook Lyndhurst Ltd.

The Case for Sustainability

- An increasing range of national policies support and promote the sustainable development of the UK.
- The NHS has a clear role to play in helping the UK achieve its sustainable development objectives.
- Sustainable development brings together economic, social and environmental objectives, all of which are relevant to the NHS.
- In London, all the emerging Mayoral strategies have both health and sustainable development as over-arching objectives.
- The positive role of the NHS in economic development and regeneration is increasingly understood, and expected.

- Partnership working is an increasing requirement of large-scale projects in both the public and the private sector. Partnership working and sustainable development are mutually consistent and supportive concepts.

- Sustainability offers an approach that provides medium and long term solutions, ideally suited to the long-term thinking associated with large scale capital projects under PFI.

Putting it into Practice – Case Studies

- The principles of sustainable development are increasingly being put into practice, and can be shown to be practical, affordable, timely and less risky.

- Schemes such as the Princess Margaret Hospital in Swindon and the Norwich & Norfolk Hospital show that a wide range of objectives – environmental sensitivity, improved waste management, energy efficiency, reduced transport impacts, improved patient outcomes, improved links to the local economy – can be met within the confines of PFI hospital development.

- Large scale office development – such as the Wessex Water offices in Bath and the CK Choi building in Canada – show that the use of recycled materials, energy efficient design and the reduction of waste can sensibly be delivered in fully commercial conditions.

- Municipal buildings such as the Energy Resource Centre in California show that, as well as a range of direct, practical impacts, sustainable building development has a role to play in educational and training terms.

- And the successful development of smaller buildings incorporating sustainability, such as the Great Notley Primary School, show that these lessons apply not just to large scale projects, but to small scale ones too.

Putting it into Practice – PFI

- The Private Finance Initiative has so far been considered principally as a more efficient method of securing value for money within the NHS.

- However, by bringing together capital and revenue considerations, PFI marks an important change from traditional methods of procurement in the public sector.

- PFI invites consideration of whole-life costs, across a range of factors, and makes it possible to offset higher initial capital expenditure against long run returns from lower operating costs.

- PFI also makes explicit reference to issues such as waste management, energy efficiency and even "externalities" as factors that can be taken into account in deciding whether bids represent value for money.

- So far, because PFI is a relative new and complex technique, the full opportunities to exploit its potential have not been widely taken up.

- The opportunity now exists to do this. The NHS in London will be committing up to **£3.5 billion** on new capital projects during 2002 and 2003. This expenditure is vital if London is to have the quality of health care it needs in the twenty first century.

- By taking on board the lessons from the case studies presented, and others, PFI can be used not only to deliver efficient and effective healthcare developments, but also to address the wider issues of sustainable development.

Putting it into Practice – The Contractor Position

- A possible concern when considering how to incorporate sustainability into the specifications for a PFI contract is that potential contractors will be deterred from submitting bids. If bids are deterred, then it will not be possible to ensure that full value for money will have been secured.

- However, there is no reason to suppose that contractors will be deterred. The Main Contractor Group is in regular dialogue with the NHS, and the "Design Development Protocol for PFI Schemes" makes reference to a number of sustainability issues.

- More importantly, many large contractors are quite explicit about their commitment towards environmental and sustainability issues, and go much further than the MCG as a whole.

- The report presents evidence for just a few contractors – including Carillion, Bovis Lend Lease and Ove Arup – to show this.

Conclusions

- Policies at national and London-level, both within and around the NHS, place the process of sustainable development high on the agenda.

- The mechanisms of PFI can be used formally to incorporate this agenda into the current capital spending programme in London, which has a value of up to £3.5 billion.

- Numerous examples exist showing how sustainability can be practically deployed, in ways that are practical, affordable, timely and less risky.

- The potential benefits for London and Londoners, in economic, social, environmental and healthcare terms are enormous. The current opportunities should not be missed.

Building for Health

The Case for Sustainable PFI

in London

April 2002

Brook Lyndhurst Ltd
on behalf of the Building for Health Promoter Group

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Brook Lyndhurst warrants that all reasonable skill and care has been used in preparing this report. Notwithstanding this warranty, Brook Lyndhurst shall not be under any liability for loss of profit, business, revenues or any special indirect or consequential damage of any nature whatsoever or loss of anticipated saving or for any increased costs sustained by the client or his or her servants or agents arising in any way whether directly or indirectly as a result of reliance on this report or of any error or defect in this report.

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- Policies at national and London-level, both within and around the NHS, place the process of sustainable development high on the agenda.
- The mechanisms of PFI can be used formally to incorporate this agenda into the current capital spending programme in London, which has a value of up to £3.5 billion.
- Numerous examples exist showing how sustainability can be practically deployed, in ways that are practical, affordable, timely and less risky.
- The potential benefits for London and Londoners, in economic, social, environmental and healthcare terms are enormous. The current opportunities should not be missed.

I Introduction

"How can capital expenditure on the health service in London most effectively contribute to the health, as well as the health care of Londoners?"

The NHS in London will be committing up to £3.5 billion on new capital investment projects during 2002 and 2003. This expenditure is vital if London is to have the quality of health care it needs in the twenty first century.

As well as significantly affecting healthcare provision, expenditure on this scale will have wide social, economic and environmental impacts. The London Regional Office of the NHS has already researched the wider economic significance of the NHS in the capital; and is exploring how forthcoming capital spending can play a key role in regenerating some of London's more deprived communities.

The wider environmental impacts will also be significant, whether in terms of energy use, waste management or transport issues. Together, these effects impact upon the health of Londoners. The NHS has a responsibility to improve health and can do so, as a corporate citizen, at the same time as providing health care.

The most advanced capital projects around the world look to incorporate economic, social and environmental objectives – in short, sustainability – in their founding ambitions. The current spending round presents an ideal opportunity for sustainability objectives to be built into new London health schemes through the structure of the Private Finance Initiative – an opportunity that should not be missed.

The purpose of the Building For Health project is to show through examples that it is:

- Practical
- Affordable
- Timely
- Less risky

to incorporate sustainability principles into the current capital spending programme.

Examples of completed buildings – not just health related, but from across the range of uses – show that the many issues related to health and sustainability have already been addressed around the world. The opportunity exists to take from these examples of best practice, and deploy them as ordinary practice in the design, building and operation of new health care provision in London.

1.1 Method & Sources

This report is the outcome of a concise, largely desk-based exercise, supplemented by limited face-to-face discussions.

Discussions took place with members of the promoter group (see below), with experts in the application of PFI within the NHS, and with a range of architects, developers and construction specialists.

Extensive web-searches were used to collect provisional data on a long list of case study examples, before a short list was assembled. More detailed information on these examples was then gathered, from web-sites, documents, videos and through discussion with scheme participants.

1.2 Structure of the Report

In the next section, we highlight **the case for sustainability**. We summarise some of the main issues associated with sustainability, its relevance to the National Health Service both nationally, and more specifically in the London region, and briefly examine two previous examples where environmental factors were expressly included within new hospital design. We also discuss the current policy environment in the UK which influences the dissemination and deployment of sustainability and the wider issues such as regeneration and land planning which are associated with this.

Following this, we show that **it can be done**. We present **six** examples of completed buildings – two healthcare facilities, three offices and one other, smaller building – that, between them, illustrate how a range of healthcare and sustainability objectives have already been met.

In Section 4, we review these case studies, to highlight where evidence is greatest and where it is weakest.

Section 5 looks at PFI, and shows the **scope within PFI projects to address sustainability** issues.

Section 6 shows that the **private contractors** capable of delivering PFI projects are alert to, indeed positively embrace, the sustainability agenda. The examples in this section clearly illustrate that the inclusion of sustainability criteria in PFI contracts will not be a barrier to the receipt of acceptable, competitive bids.

Finally, we draw some conclusions from the examples, and suggest ways forward.

1.3 Project Supporters

This project is supported by:

NHS London Region; AECOM/Maunsell plc; Environment Agency; Forum for the Future; The Natural Step; King's Fund; London First; and Robin Stott, of Lewisham Hospital.

II Background – The Case for Sustainability

This section of the paper introduces the concept of sustainability and the current policy environment for sustainability both in the UK and in the London Region. It also argues the case for sustainable hospitals and highlights two previous case studies in the NHS where environmental principles have been used with some degree of success.

2.1 Sustainability

> "At its heart is the simple idea of ensuring a better quality of life for everyone now and for generations to come"

In its simplest form sustainable development is the integration of social, economic and environmental objectives. It has achieved increasing currency over the course of the last decade, particularly following the impetus of the Rio Earth Summit in 1992.

The 1999 UK Sustainable Development strategy 'A Better Quality of Life' defines sustainable development as ensuring a better quality of life for everyone, now and in generations to come. It highlights four main objectives[1] that need to be met to achieve this goal.

a. social progress that meets the needs of everyone
b. effective protection of the environment
c. prudent use of natural resources
d. maintenance of high and stable levels of economic growth and employment

'A Better Quality of Life' indicates that a healthy population is a key indicator of sustainable development in the UK, and Gro Bruntland, the Director General of the World Health Organisation supports this view:

[1] http://www.sustainable-development.gov.uk/uk_strategy/factsheets/health/

> "...if peoples health improves, they make a real contribution to their nation's prosperity. In my judgement, good health is not only an important concern for individuals, it plays a central role in achieving sustainable economic growth and an effective use of resources...."

The UK Strategy includes thirteen other headline indicators, including education, crime, and water quality, which will be at the core of future reports on progress towards sustainable development. The links and relationship between these various indicators must be considered in order to show whether or not we are achieving a better quality of life.

Although sustainability is a widely used term, and despite the existence of a national strategy, its definition is still interpreted very differently by different audiences. There are no commonly agreed rules about what sustainability 'is', nor whether we are talking about the same thing as others when we say 'sustainability', 'sustainable development', 'sustainable healthcare' etc.

An important practical effect of this confusion is that it remains difficult to specify what sort of actions – by individuals, institutions or governments – unambiguously promote sustainable development. As a result, many strategies – regional economic development strategies, corporate strategies and regeneration strategies, for example – make many general remarks about sustainability, but typically struggle with the specifics.

The NHS is not alone, therefore, in finding itself in a position where it is being expected to take sustainability seriously, and to make a contribution to the sustainable development of the UK, but is unclear how best to do this. There are, simultaneously, many other urgent pressures upon decision-makers, which tend to push this difficult subject towards the bottom of the in-tray.

Incorporating the principles of sustainability is no longer an optional extra, however. In fact, it may offer the best route forward to medium-term and longer-term solutions to many of the urgent challenges currently facing the NHS.

Many practical actions will need to be taken in order to bring about a national health service that is itself more sustainable, and contributes more effectively to

the sustainable development of the UK. This report concerns itself with practical steps that can be taken particularly with respect to the development of new healthcare facilities, and suggests that PFI provides an ideal method for taking these steps.

2.2 Sustainability in the NHS

The NHS forms a vital part of the UK economy. As well as being the largest employer in England - providing a working environment for over one million people - it commands an annual budget of around £40 billion.[2] Healthcare facilities make a significant contribution as civic buildings that serve a community. (The NHS also has the largest property portfolio in Europe, ranging from Victorian to contemporary with a replacement value of around £72 billion[3]). Additionally hospitals can play an important role in regeneration programmes in both rural and urban locations[4]. Developments can support the generation of social networks, information exchange, health promotion and employment.

The NHS has an important role in ensuring national progress towards sustainability, and this role is not just limited to treating the sick. It must consider how it can work to improve the nation's well being through minimising environmental harm. A hospital's activity can affect the health of local communities – for example through air pollution as a result of congestion. The impact of NHS buildings on their surrounding environments is summarised in Appendix 1. It is vital that the next wave of government spending addresses not just healthcare priorities but also the wider determinants of health - in short, the issues of sustainability.

2.3 National Policy Environment

Two recent Health White Papers - 'Saving Lives: Our healthier Nation' and 'The New NHS: modern, dependable' - provide a map for the future of healthcare in the UK and discuss some issues surrounding sustainability. Both stress the need for increased efficiency, Health Improvement Programmes and Primary Care level treatment[5]. The NHS Plan promises new healthcare facilities and increased

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[2] 'Sustainable Development in the NHS'

[3] http://www.nao.gov.uk/publications/nao_reports/00-01/000187.pdf

[4] 'Building a 2020 vision: future health care environments' The Nuffield Trust 2001

[5] 'Sustainable Development in the NHS'

investment, which represent a huge opportunity for the inclusion of sustainable development.

Three initiatives serve as examples of how the policy environment for the NHS is developing:

- **ProCure 21 and Sold on Health**: 2 new initiatives aimed at making the best and most cost effective use of NHS Estates.

- **Controls Assurance**: Self-assessment: requires NHS to move beyond just reporting financial controls and address wider risk management and organisational issues. Several of these standards include sustainable development and environment issues such as waste management and transport.

- **The Design Development Protocol for PFI Schemes** - mentions the need to include sustainability into proposals for new development projects but it does not go far enough.

2.4 London Policy Environment

The implication of the current policy framework, both within the NHS and nationally, will be particularly significant for London. Improving the healthcare of Londoners has become one of the Mayor's priorities. Indeed, health is one of the three overarching themes being used to ensure consistency between all the various Mayoral strategies (covering land use planning, economic development, transport, waste and so on). The other two themes are equalities, and sustainable development.

The recent formation of the London Health Commission[6] demonstrates this commitment. The Commission brings together organisations from across the city to tackle health inequalities and improve the health of Londoners. It will build on the partnerships that developed the London Health Strategy over 2001 and its key aims will be to ensure that all policies and actions take health impacts into account as well as reducing inequalities in health amongst different groups and communities.

2.5 Regeneration, partnerships and planning

Health facilities have a strong contribution to make to regeneration in London. Regeneration can provide the opportunity for health care to be integrated into redevelopment strategies at all levels and thus make a contribution to the local environment, to local social capital and to local economic well-being.

Providing deprived areas with sustainable healthcare facilities can improve economic conditions by providing employment and building community facilities. Through supply-chains, too, the construction and running of healthcare facilities can benefit local economies. (Local sourcing also helps to reduce transportation, with both financial and environmental benefits). Such facilities can promote regeneration in terms of infrastructure, and generally address the underlying issues of why people seek healthcare in the first place. Evidence from other research suggests that in deprived areas, the way in which local people are involved in the process of change is crucially important to how a regeneration initiative affects health and well being.

For the NHS, as for other large organisations, the regeneration agenda above all involves participation in partnerships. Partnership working is rarely straightforward, since it invariably brings together individuals and organisations with different perspectives, different working patterns and different expectations. Many partnerships take a considerable period of time to develop from inception to a point where effective, collaborative projects are routine.

However, in situations where there are common objectives, and where there is sufficient commitment from partners, partnership working can be the most effective way of delivering large-scale change. Indeed, this principle lies behind much of central government policy, whether in terms of regeneration directly (through, for example, the requirement for partnership boards on Single Regeneration Budget projects), local government more generally (with the emergence of Local Strategic Partnerships) or in the NHS itself (with PFI a specific instance of the more general PPP – Public Private Partnership).

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[6] This Commission is formed jointly with the NHS Executive, King's Fund Association for London Government, Government Office for London, Social Care Region and others.

Partnership working may appear cumbersome initially, since it requires all participants to spend time talking and learning, sometimes at the expense of doing. However, in the medium and longer term it serves to reduce risk. A large scale project that has engaged all its stakeholders from the beginning is much less likely to encounter difficulties from those stakeholders in the future.

This can be particularly relevant to land use planning. Physical developments by the NHS need planning permission from the relevant local authority, as do all physical developments. Negotiations concerning planning permission can often be difficult and time-consuming. Such negotiations can be improved dramatically if they take place in a climate where partnership working is already established. Partnership promotes mutual understanding, increasing the likelihood that both sides will be able to reach agreement on what is and is not required and acceptable.

To an extent, therefore, the current phase of capital development in the NHS in London has no choice but to move forward through participation in a variety of partnerships, since the policy environment requires it. We are suggesting that this should not be seen as a tiresome, additional cost, but as an advantage, as a means of delivering better, more integrated projects, with reduced risks of future difficulties.

2.6 Two Recent Examples

Until very recently, there were only two examples in the UK of NHS hospitals that had explicitly incorporated environmental factors into their design and maintenance. St Mary's Hospital, in the Isle of Wight, and Wansbeck General, in Northumberland, were both designed to be the first energy efficient hospitals. In doing so they meet some of the criteria necessary for a sustainable hospital, but did not consider the wider economic and social impacts which such large developments can have. They nevertheless provide important evidence that at least some of the factors comprising sustainability have already been tackled within the NHS.

St Mary's Hospital, Isle of Wight

This was the first of two low energy hospitals. It is based on the Nucleus concept and was built to demonstrate how energy consumption can be reduced in new

and also existing hospitals. The resulting reduction in environmental pollution and reduced CO^2 emissions provides a contribution to the greening of the NHS.

- The Department of Health has issued results showing that St Mary's achieved a 50% saving in fuel energy by its third year of occupation.
- It has saved approximately £150,000 and reduced CO_2 emission by some 3,500 tonnes[7].
- During the first year of operation, savings in energy amounted to 35%. In the second year this figure had increased to 44%, resulting in savings of £51,000 and reduction in CO2 emissions of 1,000 tonnes.

Wansbeck General Hospital, Northumberland

Wansbeck in Ashington, Northumbria was the second hospital to be built based upon the same principles as those applied in St Mary's. Over the three years since the hospital has implemented its low energy design features, it has saved some £273,300 and reduced CO_2 emission by some 5,800 tonnes[8]. A cost benefit analysis can be found in Appendix 2.

- In its first year of operation, the hospital was assessed to have used 35.5% less energy than a comparable hospital.
- In the second and third years the hospital used 44% and 37% respectively less energy than a comparable hospital
- These savings were achieved despite a considerable increase in the overall activity of the hospital.

However, there were a number of energy saving measures which did not prove to be cost effective over the three year period (See Appendix 3).

It is estimated that if the current levels of energy saving which were achieved in both these hospitals could be achieved in the National Health Service there would savings that would exceed £200 million annually[9].

These two case studies provide valuable information for any hospital projects wishing to incorporate sustainability features into their design. Building a

[7] http://www.sustainable-development.gov.uk/uk_strategy/factsheets/health/

[8] http://www.sustainable-development.gov.uk/uk_strategy/factsheets/health/

[9] http://www.environment97.org/text/reception/r/keypapers/papers/s20.htm

sustainable hospital is not, however, solely based upon reducing energy use. For this report, we looked at a broader range of key indicators that more effectively map out the characteristics of sustainability:

- Transport
- Waste and recycling
- Health outcomes
- Embodied Energy
- Local sourcing and employment
- Productivity
- Space (internal and external)
- Water consumption

It is worth reflecting on the fact that the relative significance of these indicators will vary over time, and that some will be particularly important during the construction phase, and some will be more important during the operational phase. For some, such as waste and recycling, there is an important role in both phases, but its composition, and the techniques required to address it, will vary.

The case studies in Section 3 seek to demonstrate that, even within standard financial limits, many if not all of these issues can and have been tackled, and that the principles of sustainability can be incorporated into the design, building and operation of health care facilities.

2.7 Scale

It is not just large hospitals that can include sustainability into their design; there are around 11,000 general practices in the UK.

NHS LIFT (Local Improvement Finance Trust) is a recent initiative designed by the Department of Health aimed at developing public private partnerships to build and refurbish, smaller primary care premises and then lease them out to GP's, pharmacists and dentists. There is scope within this initiative to encourage developers to address sustainability issues.

The general literature on best practice in building design and construction is very extensive, and covers buildings of all shapes, sizes and purposes. In the

following section we present just six examples, five large and one small, to give some flavour of this range.

III Putting it into Practice - The Case Studies

This section of the report discusses six buildings that demonstrate the benefits of incorporating sustainability into building design and construction. A number of other examples were researched: these have been referenced throughout the chapter, and details are presented in Appendices.

Not all of the case studies selected are health care facilities and this is for two main reasons:

1. There are currently few examples in the UK where a range of sustainability indicators has been included in construction, particularly hospitals.

2. Although this report focuses specifically on the NHS, the principles and benefits of sustainability can be applied to a range of building types.

The main case studies used in this section were chosen for their innovation in terms of sustainability. Although no one case study covers all of the individual indicators mentioned in Section 2.6, together these cases present a compelling picture for the inclusion of sustainability into new hospital projects.

It is also important to note that some of the indicators mentioned above are still relatively new. Methodologies for calculating life-cycle costs and benefits, for example, are still not widespread (the redevelopment programme at Whipps Cross, for example, is sponsoring two PhD students to explore life-cycle cost issues.)

This is particularly relevant given the opportunity presented by PFI. As we suggest more fully in Section 4, PFI actually improves the ability of the public sector to incorporate sustainability into capital spending programmes. PFI identifies four main areas for project assessment, and we have borne these in mind in selecting and presenting the case studies.

In terms of PFI, the areas upon which the cases focus are as follows:

Property and Opportunity Costs	Information on contract values
Capital costs (including lifecycle costs)	Energy costs Waste costs
Service costs (clinical and non-clinical)	Healthcare outcomes Staff productivity Re-cycling
Other (including externalities)	Transport Local sourcing

3.1 Princess Margaret Hospital Relocation Project, Swindon

Current best practice in the UK of a PFI NHS hospital incorporating a wide range of sustainable development principles.

Size	56,000m^2 and 486 beds
Construction	June 1999-August 2002
Cost	£100M
Architects	Wichelmow McFarlane HDR
Developer	The Hospital Company (branch of Carillion plc)

This construction project is a demonstration project for the M4I (Movement for Innovation) and it is unique in the way the social and economic issues have been included alongside environmental factors in its design and construction using The Natural Step[10].

The original hospital had fallen into a state of disrepair and was not big enough to cope with the increasing numbers of admissions. Funding for the hospital was secured through the Private Finance Initiative and The Hospital Company.

A key feature of this hospital is that local community involvement was considered before construction began, leading to the employment of local contractors and labour. As a result, 105 people have been sourced locally with another 7,000 now registered on the site employment database[11]. A special officer was appointed to manage community relations and this role included addressing any concerns within the community during the actual construction phase. Similar examples demonstrating the benefits of creating local community partnerships can be found in Appendix 4.

The Princess Margaret Hospital used many of the innovative sustainability issues incorporated into the design of the Darent Valley Hospital in Dartford. Further information on this project can be found in Appendix 5.

[10] www.naturalstep.org.uk
[11] http://www.carillionplc.com/hp-index4.htm

Construction

Savings through use of the Sustainable Action Plan[12] at end of construction period:

Waste Management	£87, 788
Materials	£905, 700
Total:	£993, 488

- Subcontractors and suppliers who have joined in with the Sustainability Action Plan have also made significant financial savings[13].
- At management level on the construction site the culture is to incorporate sustainability thinking as part of the normal process.
- Through training and implementation of The Natural Step system conditions everyone on site was aware of their impacts and their effect on the environment.

On site initiatives:

- Workshops held with subcontractors to improve knowledge on sustainability issues relevant to the project.
- Use of "Hippo" water saving devices to reduce water usage in WC's by 1.5 litres/flush.

Waste Management

- Recycling of all waste materials on site with a special initiative to segregate different types of waste on site. Objective was to reduce waste by 50%.
- Lorry movements associated with the reduction of waste going to landfill.
- Procurement of materials from suppliers able to take back and recycle packaging.
- Landscaping to minimise waste soil on site.
- Purchasing policies to favour recycled materials and those with a long life.

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[12] The SAP was produced providing short, medium and long term actions

[13] http://www.carillionplc.com/sustain/per_260.htm. The Sustainability Action Plan was funded by an EU research programme called ADAPT.

- It is estimated that the hospital will produce up to 40% less CO_2 than a similar sized more traditional hospital.

Materials

- Use of timber from sustainable sources.
- Use of rubber and linoleum in preference of PVC based materials.
- Encouragement of suppliers to offer technological development.
- Hard floor finishes on atrium floors, which can be easily replaced if damage meaning a reduction in downtime and inconvenience.
- Favour suppliers developing 'green' products.
- Use of water based paints to reduce Volatile Organic Compounds (VOC's) and enhance end building quality.

Energy Usage

- Incorporation of energy efficient features of design such as solar glazing, effective insulation materials, low energy lighting.
- It is predicted that the new hospital will consume 30% less energy and emit 35% less CO_2 than an equivalent building.
- Double insulation in the roof is predicted at lifetime energy savings in the region of **£250,000**.
- Aluminium roofs were has been specified, as these can be recycled at a later date.

Transport

- Route planning to minimise disruption.
- Minimisation of vehicle movements by maximising loads.
- All vehicles used in construction had emission levels checked regularly.
- Provision of transport for staff to reduce vehicle movements.
- The hospital incorporates a public transport lounge to facilitate journeys of passengers using buses.

Wildlife Management

- Habitat management plan.
- Native tree planting.
- Protection of resident populations e.g. provision of bird boxes.

Other Issues

The planning process for the hospital highlighted some conflict with sustainable development principles, particularly in relation to the use of greenfield land, access and transportation. A brownfield site would have been preferred but it did not comply with the Swindon NHS Trust development specification. An Environmental Impact Assessment helped address some of the concerns about congestion and it was this EIA, alongside the Trust's realisation that the hospital was an important facility, and by its very nature would create large amounts of traffic, which persuaded the Local Planning Authority to support the application.

3.2 Norfolk and Norwich University Hospital (NNUH)

A large hospital whose design is principally based upon patient and staff movement to minimise internal transportation.

Capacity	953 beds
Size	85 000 m2
Completion date	1999
Cost	£229M
Architects	Anshen Dyer

This example has been selected because it was one of the largest regional hospitals to be constructed under the PFI scheme in the UK. The Norfolk and Norwich hospital incorporates a number of aspects of good sustainability practice, with particular attention paid to the idea that good building design can have an effect on patient outcomes. There have been relatively few studies in the UK that provide evidence for this, although it is an idea which is being incorporated into more and more healthcare projects, such as the £230 million, 16-year redevelopment of the Great Ormond Street Children's hospital[14]. More information and case studies on patient outcomes can be found in Appendix x.

The hospital is made up of five areas:

a) In-patients
b) Diagnostics
c) Out-patients
d) Office areas
e) Atria

NNUH has been designed around these area types, based on studies of patient and staff movement and by doing so has achieved the following:

- Minimised transportation of patients.
- Reduced used of lifts.
- Easy control of services supplied to specific areas e.g. 'day' care patients are separated from the 24 hour areas for different management patterns.

[14] http://www.ich.ucl.ac.uk/gos2000/html_files/p10.html

Key sustainable design features:

- Maximum use of natural ventilation, which creates a cleaner, healthier feeling.
- Use of Combined Heat and Power (CHP) will is to be installed two years after commissioning in order to match the requirements of the operational hospital.
- Rooms have been designed to ensure flexibility: standardisation will allow their use to change with the hospitals requirements.
- Wards are small and arranged in diamond plans with centralised nursing facilities which gives patients a feeling of intimacy.
- All the walls are concrete with brick cladding and are thicker than standard, therefore acting as thermal sinks, moderating day and night time temperatures.
- Trees are used to shelter exposed areas, again maximising thermal efficiency.
- Choice of bricks as a construction material was based on whole-life maintenance costs as well as its low purchase and construction costs.
- During the design phase, there was regular consultation with both the NHS and local community groups[15].

[15] In total 70 different user groups were consulted, involving over 1000 people

3.3 Wessex Water HQ

Described as 'the greenest office in the UK', it won the BCIA (British Construction Industry Award) Building of the Year Award.

Capacity	580 people
Size	10 000m^2
Construction	Feb 1999 – July 2000 (75 weeks)
Cost	£21.5M
Architects	Bennetts Associates

"Wessex water is wholly committed to sustainability"

Wessex Water have incorporated numerous environmental sustainability features into their Bath offices through the help of 'The Natural Step'[16] and the Building Research Establishment.

Summary of low energy design features:

- East-West orientation, to aid natural ventilation and lighting, and minimise solar heat gain from high summer sun
- Exposed concrete thermal mass to absorb heat and avoid the use of artificial cooling in the offices
- Generous floor to ceiling height to enhance the effect of natural ventilation and day lighting
- Thermally efficient high quality external glazing
- Low leakage façade
- Highly insulated opaque elements
- Fixed external shading to prevent solar glare and heat gain.
- Effective internal blinds for glare control
- Controlled high level openings via a BMS for effective night cooling
- Energy efficient and effectively controlled artificial lighting scheme
- Energy efficient equipment specified
- Sustainable approach to materials specification

[16] The Natural Step operates as part of Forum for the Future in the UK

- Surface water collected from the roof and grounds to supply the irrigation system and 95% of toilet flushing requirements
- A shuttle bus service is provided for all staff to reduce car use

Facts and figures:

- 95% of toilet flushes fed from a rainwater recycling system
- Pre-cast exposed concrete soffits built using 50% less concrete than equivalent
- in situ construction techniques
- 70% of all waste was segregated for recycling on site with a net saving of £15,000 compared with sending all waste to landfill
- Consumes less than 1/3 of total energy required to power a standard headquarters office. Usual energy consumption is 300-400 KWh/m^2. This office consumes only 80-100 KWh/m^2
- 1200 yd^3 of waste produced during construction out of the total 1750yd^3 was recycled. Normally all of this would have gone to landfill
- Cost £40K to reduce waste to landfill by 70%. This figure would have been 25% higher if everything had been tipped because of the landfill tax

3.4 CK Choi Building, Canada

One of Canada's most environmentally sound building projects and described as 'the most promising example of green development'. The building has won numerous awards.

Size	30 000sq ft.
Cost	$6M
Architects	Matasuzaki Wright Architects

This building was constructed in 1993 with the single goal of achieving sustainable design and it is now considered to be one of Canada's most environmentally sound building projects. Every single decision during the process was assessed for both its immediate and long-term impact on the environment[17].

- The building was constructed using materials that are recyclable or recycled, including bricks from demolished buildings and wooden beams from UBC's Old Armouries.
- Water is preheated using waste heat from an existing steam line.
- Cooling and air exchange is provided by 100% natural ventilation. Atriums ventilate different parts of the building through a stack effect. High ceilings and windows that open also take advantage of natural ventilation.
- Offices are placed to optimise natural light, so the building requires less than one-third the artificial lighting typically used in an office building. Daylight sensors automatically dim indoor lighting.
- Its energy efficient design reduces UBC's electricity use by 192,000 kilowatt-hours each year, the equivalent of the amount of energy used annually by 19 single family homes. This provides a savings of $9,600 a year.
- Waterless, odourless composting toilets require no sewer connections and produce fertiliser for the gardens. The aerobic composting system reduces volume of waste by 90%.
- Recycled grey water from sinks and captured rainwater is used for landscaping watering, cutting water consumption in half.
- Gingko trees were included in the landscaping, as they are known for their ability to clean air of pollutants.
- Construction materials were chosen that minimise the impact on the ozone layer.

- Environmental Management: existing trees were retained for their capacity to remove CO_2 from the air and the shade they provide on the west elevation.
- Tenant Awareness: part of the project includes educating users about building features and items over which they have control e.g.: operable windows and use control over heat in work spaces. Understanding the processes which are in place enables users to participate in energy efficient operations.

[17] http://www.iar.ubc.ca/choibuilding/matsuzaki.html

3.5 The Energy Resource Centre, California

The ERC has been nationally and internationally recognised as a leading example of cutting edge sustainable design in commercial facilities. Designed so its function could change as the needs of its customers changed, it is designated by the US Environmental Protection Agency as an "Energy Star" building.

Cost $6.75M

This Southern Californian Gas Company demolished their original building and approximately 400 tons of its material was incorporated into the new structure. The remaining waste materials were then sold to other developers for reuse. In total, 62% of the original building was used in the new structure. Savings of over **$3 million** were made through incorporating energy efficient measures making the building 40% more efficient than comparable buildings.

Summary of sustainable design features

- All the wall panelling is made of recycled newspapers and covered with sisal, a fabric made from recycled tropical plants
- The 100% recycled floor was reclaimed from a disused warehouse in San Francisco
- Rubber tyres were boiled and used as an alternative to tarmac, creating a quieter, and longer lasting surface
- Super insulating windows added an extra $250,000 to the cost of the building, however the $25,000 they will generate in annual energy savings means they will have paid for themselves in 10 years

Other Issues

The ERC has provided information, training and demonstrations to thousands of businesses throughout America on how to integrate sustainability into their office environments. In its first two years, the Centre had over 50,000 people visit the facility for demonstrations and tours[18].

[18] http://www.usgbc.org/resource/erc.htm#top

3.6 Great Notley Primary School, Essex

Built as a result of an international competition set by the Design Council to develop a prototype sustainable school building that could be created for the standard school budget. Received an RIBA Award.

Cost	£1.6M
Construction	04/97 – 08/99
Architects	Alfred Hall Monaghan and Morris

A considerable amount of time went into consumer consultation and research into the local community's needs for the new school. This did prove to be difficult because the school was built in an area where new housing developments were being constructed. Consultation was very difficult because at the time of design not many prospective parents were resident. This required a very proactive approach to be taken by the client. The tight budget challenged the developers but there were still a number of sustainable design features.

The project has produced:

- A best practise tool for future projects
- A teaching framework for higher education, addressing sustainability
- An interactive learning environment

- The school is designed with consideration of the Kyoto Earth Summit which focuses on reducing CO2 emissions
- Local firms were used to supply some of the construction materials, thus reducing transportation costs, minimising embodied energy and boosting the local economy
- The 'green' roof is planted with sedums which needs very little maintenance, provides insulation, and provides a microhabitat for small animals
- The design means that the school can be used for local community groups outside school hours

3.7 Case Study Review

The case studies shown above highlight the considerable benefits that can be achieved by including sustainability issues into the design and construction of new buildings. All of these projects have been commercially and functionally successful, whilst at the same time reducing environmental impacts by being both energy efficient and adopting simple waste management techniques.

In the case of the Princess Margaret Hospital in Swindon, these benefits were achieved without lengthening the construction phase; it took only 18 months for the construction programme to be designed and for funding to be approved. This example confirms the notion that including sustainability into hospital design need not increase the time required. Sustainable healthcare development can still be a **timely** process.

Spending time on the design phase can, however, minimise risks that could occur later on, both during and after construction. Forging Community Partnerships along with regular local consultation, as done on the Norfolk & Norwich Hospitals, as well as the Princess Margaret project, can also make a development **less risky**. Concerns can be raised and resolved early on, and help give local people – and other local partners - a sense of involvement and to a certain extent an element of 'ownership'.

The range of examples used in this report demonstrates that examples of best practice can be applied across a range of building type and size, and within a range of time and budget constraints. The design team for Great Notley primary school had to work within rigid financial budgets whilst at the same time produce something that could be used as a prototype for other schools. Sustainable building design need not be a costly process. In fact, it can work out more **affordable** when the whole-life cycle of the building is considered. Energy efficiency, waste management and choice of sustainable materials can actually reduce the running and maintenance costs of a building.

Although the examples are mainly 'new' buildings there is scope for the redevelopment and renovation of existing sites and buildings.

Section 2.6 listed a number of indicators, which should define whether or not a building is 'sustainable', or not. None of the case studies included and referenced <u>all</u> of these indicators - particular gaps in data relate to staff productivity, embodied energy and transport. Most of the research done on the relationship

between productivity and building design has taken place outside the UK and this is an area that requires further investigation. Anecdotal evidence in the UK – most notably from the BA Waterside HQ in West London – suggests that good design can both improve the efficiency with which a building is used, and the attractiveness of that building. Early assessment of the BA Waterside development suggests that the former factor has indeed led to increased staff productivity, while the latter factor has led to reduced absenteeism.

The concept of 'embodied energy' is also underdeveloped and underused, although as the notion and understanding of sustainability increases so will the number of development projects which incorporate the idea of embodied energy.

Sustainability, as explained, should consider social, economic and environmental issues. Often sustainability is only considered in environmental terms as some of the above case studies demonstrate. This is sometimes because the environmental impacts of a development project are more quantifiable, and indicators to measure environmental impact are already widely used. There needs to be an equal emphasis placed on the social and economic issues surrounding new buildings, particularly when referring to health care, where people - i.e. patients -are the core of this system.

The economic and social impacts of a hospital are much less visible but by no means less important. In fact the opposite may actually be the case. A healthier population is one which can make a greater contribution to the overall economy, and people who are integrated and involved in their communities (and a hospital can form a large part of that community) could be said as having a higher quality of life, which consequently results in a better level of health. It therefore seems **practical** for the NHS to adopt sustainability, both generally and with specific regard to its buildings: if it is able to improve its estate management it is more likely to achieve is healthcare goals for the population. Individuals expect the NHS to be doing their utmost to provide a high quality of healthcare as well as trying to make the population healthier overall and the inclusion of some of the initiatives which are discussed in the case studies could help the NHS achieve this objective.

Failure to integrate the three key components of sustainability is highlighted in the case of the Norfolk and Norwich hospital. NNUH is a large hospital located away from Norwich city centre, although there is no space in the city centre for an acute hospital of this size anyway. Over 2,300 parking spaces for visitors and staff were created but not in line with any specific transport plan. The resultant

environmental impact caused by congestion and air pollution could be considerable if this issue is not addressed.

The case of Stepping Hill Hospital in Stockport is an example of how NNUH could over come this problem. Below is a summary of Stepping Hill's sustainable transport initiatives:

1. The hospital has negotiated with local train and bus operators to secure a discount on employee travel cards. This may be further subsidised by the hospital to give a 20-30% discount. This scheme will be funded by car parking revenue.
2. Staff are encouraged to walk or cycle to work and are able to hire bicycles at 50p per week for two years, after which they have an option to purchase the bike at a discounted price.
3. A care sharing database has been set up to improve occupancy levels of staff vehicles. This scheme includes a free taxi ride home if an employee must return home in an emergency or if they are unwell. Car sharers can park free of charge, whilst other staff and visitors must pay. This revenue pays for the car sharing and bicycle schemes.

As with other "green travel plans" around the country, these transport solutions are intuitively appealing and make common sense. As yet, however, little has been done to demonstrate the cost-benefit analysis of such schemes, and this is another area where further work needs to be done to provide quantified evidence.

Overall, the case studies show that the principles of sustainability can indeed be incorporated into modern, commercially and functionally successful buildings. Quantifiable evidence for this covers a number of key indicators, though further work is needed to complete the coverage. Nevertheless, the examples show clearly that sustainable development in the NHS can be **affordable, timely, practical and less risky** than traditional approaches. For a building to be truly sustainable designers, architects, developers and contractors must address the whole sustainability perspective, and not just focus on one of its components.

IV Putting it into Practice - PFI

The Private Finance Initiative is one model of Public Private Partnerships in the NHS. PFI is a key policy for improving the quality and cost-effectiveness of public services. It enlists the skills and expertise of the private sector in providing public services and facilities. It is not simply about the financing of capital investments, but about exploiting the full range of private sector management, commercial and creative skills.

In the health sector, the NHS will continue to be responsible for providing high quality clinical care to patients. But, where capital investment is required, there will increasingly be a role for private sector partners in the provision of facilities.

Major PFI schemes are typically DBFO (design, build, finance and operate). This means that the private sector partner is responsible for:

- designing the facilities (based on the requirements specified by the NHS)
- building the facilities (to time and a fixed cost)
- financing the capital cost (with the return to be recovered through continuing to make the facilities available and meeting the NHS's requirements)
- operating the facilities (providing facilities management and other support services)

Risks in each of these areas will be assumed by the PFI partners best placed to bear them, in such a way as to reduce the overall risks associated with procuring new assets and services for the NHS. Moreover, because the PFI partner's capital is at risk, they will have strong incentives to continue to perform well throughout the life of the contract.

In the UK there are currently 179 PFI projects that have been completed, or are in the pipeline, for NHS hospitals and this number is growing rapidly. Of these, 28 are based in the London region (see Appendix x).

NHS Trusts will continue to be the employer of clinical staff. PFI in health is about ensuring that the facilities in which they work are as modern, efficient and cost-effective as possible by placing responsibility for their provision to specialist managers who are expert at providing them. The NHS can then concentrate on the provision of healthcare.

The essence of PFI is that the NHS defines its need in terms of "outputs" - that is the nature and level of service required, and invites private sector bidders to present their solutions to meet these service needs. This allows the private sector to make the fullest possible use of its experience and skills in order to bring innovative solutions to the needs of the health service.

Any PFI scheme must demonstrate Value for Money (VFM). Critically, best VFM is the optimum combination of whole life costs and benefits.

This whole life approach creates excellent opportunities to incorporate the principles of sustainability, which are long run in nature. Traditional capital spending in the public sector is separated from revenue. Potential revenue savings from initially higher capital spending have not, therefore, provided an incentive to adopt capital projects that address long run issues.

Within PFI, however, potential savings in the long run – and in PFI, this can be over a 25 or even 30 year period – can be set against higher capital costs in the short run. In the case of energy, for example, as the case studies in the previous section showed, sometimes the initial costs of energy efficient installations can be higher than standard (or traditional) installations, but the excess cost can be recouped sometimes in just a few years.

4.1 PFI and sustainability

> "The beauty of PFI is that it focuses on the whole life cost. I can assure you that its good economics for us to invest in sustainable construction practises"[19]
>
> *Andrew Brown, Project Manager from Carillion for Princess Margaret Hospital in Swindon*

[19] http://www.m4i.org.uk/innovations/case_histories/proj124_in01/index.htm

PFI schemes assess whole life costs and benefits against four broad headings:

- Property and Opportunity Costs (initial and residual values etc)
- Capital costs (including lifecycle costs)
- Service costs (including both clinical and non-clinical services)
- Other (including externalities)

The complexities and relative novelty of PFI has meant that, so far, opportunities to take account of sustainability have not, generally, been taken. Whilst the "Design Development Protocol for PFI Schemes", developed jointly between the NHS and the Major Contractors Group (MCG), makes important steps in the right direction, many of the features of sustainability have only a low profile in the documentation. By viewing PFI in the context of the wider policy context, for both sustainable development and economic regeneration, it becomes clear that this profile should now be raised, and acted upon.

It is the purpose of this paper to show that a range of economic, environmental and social objectives can straightforwardly be into the PFI regime; that many instances in which this has been done already exist; and that the NHS in London can take these on board in a way that deliver VFM.

In some cases, and for some features of sustainability, incorporating sustainable development into PFI will require the investment of modest additional time and resources. However, as the examples and argument have shown, across a whole range of factors, the benefits of this investment will be considerable in the long run, not least in terms of addressing the wider determinants of health, and thereby deliver better health to Londoners.

V Putting it into Practice – The Contractor Position

The assertion made in this report that wider sustainability and well-being objectives should be incorporated within the confines of PFI in the NHS would be meaningless if potential private sector partners were either mystified or alarmed by the prospect. If this were the case, then including "sustainability" or any related terms in either OJEC notices or other contractual documentation could undermine the ability of the NHS to secure VFM contracts.

There is ample evidence that this will not be the case. Listed in this section of the report are just a few of the UK's major companies engaged in the design, building and operation of hospitals and other buildings that clearly embrace and understand either or both of the sustainability and environmental agenda. For each organisation, brief notes indicate the scope of their activities, and their position on sustainability, drawn from company documentation.

These examples are reinforced by the operation of the Major Contractors Group (MCG), which represents 23 of the top construction companies in the UK, each with a turnover in excess of £200 million[20]. In total this group of contractors carry out over £20 billion worth of construction work each year – almost half the total output of Britain's construction industry. The Government Construction Panel recently released 'Achieving sustainability in construction procurement' which sets out a range of specific objectives for including sustainability in the procurement of public buildings and there is growing evidence to suggest that companies with sustainable development at the core of their operations outperform those who do not.

There are a number of other relevant bodies, institutions and businesses that also play a part in the advancement of sustainable building design and a list of these is provided at Appendix x.

The following list is by no means exhaustive, and is in no way intended to indicate that the companies listed are in any sense "preferred" – the list is for illustrative purposes only.

[20] http://www.constructionconfederation.co.uk/about/members.html

5.1 Carillion

One of the market leaders in terms of sustainable construction, with a portfolio of 10 PFI projects in operational phase and five in construction phase. See Section 3 for the case study of Princess Margaret's hospital, Swindon. Member of the MCG.

- Lead the consortium for the UK's first acute general hospital PFI scheme: Darent Valley Hospital for Dartford and Gravesham NHS Trust.
- Carillion's industry-leading environmental programme, initiated in 1994, is delivering significant business benefits and has been a catalyst for innovation. In line with current UK Government policy and global thinking the company broadened and extended their environment programme in 2000 to form the foundations of a sustainable development programme, which is directed by their own Sustainability Committee.

In terms of Sustainability:

- 8 RoSPA safety awards and a President's Award for 10 years of consistent operational health and safety improvement
- Carillion to pilot Business in the Community key performance indicators that measure Corporate Social Responsibility
- A reduction in the frequency rate of accidents in traditional construction activities of 24%
- Corporate community investment, in cash and kind, of over £400,000 in 2000

From Carillion's website[21]:

"As an integral part of our sustainability programme we set objectives and targets each year. We are pleased to report that of the 71 targets set across Carillion's businesses for 2000, 49, or 69% were independently verified as fully achieved, compared with 55% of targets in 1999. A further seven targets were substantially achieved. Key indicators included the level of investment in environmental protection, CO2 emissions, waste reduction and participation in the Considerate Construction Scheme."

[21] http://www.carillionplc.com/sustainability

6.2 Kier Group plc

Kier is an international construction company and was involved in the construction of the first PFI hospital in Scotland[22] as well as a number of other smaller healthcare projects around the U.K.[23] Member of the MCG.

Kier's corporate statement does not use the term "sustainability", but its approach clearly follows the principles discussed throughout this report:

"In the development of business we will promote:

- Research projects to improve industry
- Development of environmental accounts
- Environmental and engineering innovation
- Increased levels of environmental protection
- Increased maintenance and re-use of existing buildings
- Projects which improve the natural environment
- Partnering to achieve higher levels of environmental awareness and care."

[22] The 364 bed Hairmyres hospital was a £6.75M project and one of the first PFI hospitals in Scotland. It was completed three months ahead of schedule

[23] http://www.kier.co.uk/Sectors/Default.asp?sector_id=3

6.3 Bovis Lend Lease

Major multi-disciplinary construction and development company, with a strong focus on environment and a track record in healthcare developments. Member of the MCG.

"To deliver best practice facilities in the healthcare sector, Bovis Lend Lease works closely with health industry operators to fulfil their strategic business and financial objectives.

We are able to access detailed information on trends in health care delivery, infrastructure and diagnostic technology through in-house knowledge and skill bases, and through partnerships with renowned health organisations such as Johns Hopkins Medicine and Massachusetts General Hospital in the United States.

Our expertise in the delivery of health care projects provides an holistic value proposition for clients. We are able to take responsibility for the front-end strategic, commercial and functional planning of the project and then draw on the extensive technical capabilities of our organisation to deliver the objective."

Bovis Lend Lease have completed a number of hospitals in the US, and case studies in the UK includin the PFI Calderdale Royal Hospital in Halifax. Cost: £85 m, Design and Build assignment. Bovis' first completed PFI project. The Calderdale Hospital project involves the creation of a 600 bed hospital with ancillary facilities in refurbished existing buildings on the existing Halifax General Hospital site

"We are committed to **sustaining our environment** by designing and constructing buildings and infrastructure that use energy efficiently and are in harmony with the natural environment."

Illustrative projects:

- **University of Nottingham**: A campus development on a 'brownfield', former manufacturing site for the University of Nottingham. The aim of the project was to satisfy the University's green campus policy. Great care was taken to ensure that building and system design gave due consideration to material

sustainability and high levels of energy efficiency. The landscaping was sympathetic to the local surroundings and included the creation of a wildlife corridor and lake features.

The project features thermal wheel heat recovery, mixed mode ventilation, high thermal mass, photovoltaic cells, 'green roofs', and timber cladding system. The overall approach has resulted in significant cost savings whilst maintaining a high level of performance.

- **The Earth Centre, Doncaster**: The aim of the Millennium Earth Centre is to promote the message of Sustainable Development conceived by the United Nations Commission on Environment and Development in 1987. The Centre supports a sustainable earth and way of living. The project incorporates many environmental features including full water recycling, rejuvenation of coal mining sites, energy efficiency, south-facing aspect for maximum solar gain, building insulation, photovoltaic panels, reduced CO2 emissions and sustainable materials sourcing.

6.4 Ove Arup

Ove Arup believes that all major development projects should be subjected to some form of sustainability appraisal and have developed SPeAR™ (Sustainable Project Appraisal Routine).

This large engineering company have been involved in the design of three hospitals in Ireland as well as a number of large non-health sector projects such as The Channel Tunnel.

- Arup provides a complete environmental consultancy service.
- Worked on the Eden Project in Cornwall covering transport issues and conducting the environmental impact assessment.
- Been involved in various other projects that have incorporated sustainable design.
- Cover waste management, air & water quality, landscape architecture, environmental planning and contaminated land.
- Projects in the UK include: Reading Football ground, Thames Barrier Park.

It has been suggested that major development projects should be subjected to some form of sustainability appraisal but no generally accepted methodology has emerged.

Arup has responded to this situation by committing time and resources to developing SPeAR™ (Sustainable Project Appraisal Routine) a project appraisal methodology, to be used as a tool for rapid review of the sustainability of projects, plans, products and organisations.

6.5 Buro Happold

Engineering and design company with a special focus on sustainability and environmental issues.

"Buro Happold helps to assess and reduce the environmental impact of buildings, adding value to properties and businesses while meeting environmentally responsible goals that fall under the broader heading of sustainable development."

- Buro Happold were Engineers on the Wessex Water Project in Bath (see Section 3) and the new energy centre for the BBC in White City.

Their corporate services include:

- Advising on the business benefits of environmentally-responsible buildings and construction
- Strategic advice related to environmentally-responsible construction and operation of buildings and social, economic and stakeholder issues linked to sustainable development
- Detailed sustainable design advice about operational and embodied energy, waste and sustainable sourcing of energy and materials
- Assessment of environmental impact, during and after construction, using BREEAM, ENVEST, EcoHomes and other assessment tools
- Environmental impact assessments needed to obtain planning consent for large building developments
- Co-ordination and management of environmental issues during design and construction to ensure that projects meet client's environmental and sustainability goals

VI Conclusions

A powerful set of circumstances has brought about a situation in which the time is right to incorporate sustainability fully into the capital development programme of the NHS in London.

These circumstances are:

- a national policy environment that promotes sustainable development
- a series of strategies and policies for the NHS that embrace sustainability
- a London policy environment that explicitly connects health with sustainable development and economic regeneration
- a large scale investment programme, operating through the PFI, that for the first time links capital and revenue expenditure

Incorporating sustainable development means addressing economic, social and environmental goals, and doing this in a joined up way. Sustainable development moves from "joined up thinking" to "joined up doing".

This report has presented a mix of evidence and argument showing that sustainability can and should be an integral part of the design, construction and operation of hospitals within the NHS. As well as reducing costs, there is a potential to reduce health risks and liabilities, improve performance, demonstrate corporate responsibility and keep in line with government policy such as the Greening Government Initiative[24].

The processes of pursuing sustainable development can be followed in ways that are timely, affordable, practical and less risky than traditional approaches.

The long-term nature of PFI contracts creates the room within which to explore and exploit the opportunities of sustainability. The concept of 'whole-life' thinking

[24] The Greening Government Initiative is something which all government departments are committed, and it ensures that environmental considerations are taken into account in all decisions.

in planning and designing and maintaining an estate can result in long term efficiencies and performance improvement[25].

This report has only touched upon most of the relevant issues. Detailed work is underway in a number of places - academic institutions, research consultancies, within project development teams in individual NHS Trusts - that more fully explores the range of regeneration and sustainability issues which have been addressed here.

In the future, the lessons learned from these various avenues, as well as from the practical experiences of those putting it all into practice will need to be widely and continuously disseminated. The art of putting sustainability into practice is still relatively new. This report has nevertheless shown that there are already good, practical examples of how it can be done. The challenge now is to show that, applied across the whole range of NHS capital development in the next few years, the principles of sustainability can make a real difference to London, benefiting its economy, its social conditions, its environmental quality – and the health and well-being of its citizens.

[25] http://www.nhsestates.gov.uk/download/sustainable_development.pdf

Appendix 1

Main environmental and social impacts of health care facilities

Theme	Issue
Environmental	
Air Quality	Emissions from on-site boiler houses and on-site vehicles Emissions from vehicles Emissions from generation of electricity Emissions from disposal of wastes Emissions from construction activity
Surface access	Emissions from congestion from the use of cars by patients, visitors, staff and delivery vehicles
Ecology	Disruption from presence of facility in or near sensitive ecosystems
Energy	Use of energy and resources during construction operations
Waste	Production of large quantities of clinical and municipal waste
Water	Potential contamination from chemicals and fuels stored on site Consumption of water for operations and construction
Contaminated land	Contamination of land from spills and leakages of substances stored on site
Noise	Internal disruption caused by building services Disruption caused by construction
Social	
Accessibility	Restricted access to services can prevent people receiving healthcare they need Access to facilities can cause local disruption through traffic congestion and disturbance Accessibility needs to be considered through means of a transport plan
Employment	The NHS employs over one million people and has a large associated socio-economic influence It has significant potential to support local enterprise through its selection of service providers
Community Leadership	Healthcare providers are in a position where there activities can provide guidance, support or leadership to local initiatives, particularly health promotion

Appendix 2 Wansbeck hospital cost benefit analysis for year 3

http://www.environment97.org/text/reception/r/keypapers/papers/s20.htm

Element	Fuel savings fossil kWh/yr	Fuel savings electricity kWh/yr	Capital costs £	Fuel Savings £ (NPV)	Maint. & replace. costs £ (NPV)	Net savings £ (NPV)	Benefit to cost ratio
Space Heating	866,662	---	454,410	80,120	4,848	75,272	0.17
Air Treatment	1,872,725	76,262	-25,000	219,693	11,151	208,542	N/A
Boiler Efficiency	350,037	---	0	32,360	0	32,360	N/A
Hot Water System	882,918	---	16,217	81,623	6,633	74,990	4.62
Catering	826,303	-208,313	15,000	13,940	27,899	-13,959	N/A
Sterilisation	443,300	-113,483	-13,000	-28,311	-18,909	-9,402	N/A
Humidification	640,000	-102,275	-1,500	-3,283	4,848	-8,131	N/A
Low loss elec. motors	---	59,138	11,680	36,110	9,372	26,738	2.29
Roof Lights	-47,747	19,096	106,590	9,255	8,081	1,174	0.01
Automatic lighting system	---	19,610	45,000	9,920	18,405	-8,485	-0.19
Revisions to lighting	---	404,866	41,000	204,810	30,456	174,354	4.25
Run Around Coils	809,134	-29,180	52,563	56,975	51,063	5,912	0.11
Wind Turbine	---	153,808	125,000	93,965	49,779	44,186	0.35

Appendix 3

Energy saving measures which did not prove to be cost effective in Wansbeck Hospital, Northumbria

- space heating design features such as electronic radiator control valves and motorised valves linked to the building management system.
- mechanical ventilation of perimeter areas in winter as a means of avoiding heat loss
- roof lights
- automatic lighting control systems
- the use of electricity instead of gas for catering, sterilisation and humidification
- the generation of electricity by wind generator
- run around coils were shown to be economical in years 1 and 2 but not in year 3

Appendix 4 Examples of community partnerships

Albany Lodge Community Treatment Unit, St Albans

- Centre for short-term care for mentally handicapped patients
- Initially development was unpopular with local communities but through consultation this was overcome by offering use of the centres car park for car boot sales at the weekends
- During construction, two large trees needed to be removed, and working with a local art college the trees were then used to create sculptures for the grounds which could then be appreciated by staff, patients and visitors.

Organic Vegetable Scheme, Bradford

- Community support has encouraged a group of Bangladeshi women to start a gardening programme
- The effect has been to increase fitness, promote a healthy lifestyle and increase social inclusion within a deprived community, where many people are unable to speak, read or write English
- There has been a noticeable improvement in community health as well as the sharing of gardening knowledge amongst residents.

Appendix 5 Darent Valley Hospital, Dartford

Construction July 1997- Sept 2000

Developer Carillion

Not only does The Hospital Company - a private consortium led by Carillion - own and build Dartford's new 403-bed general hospital, it is responsible for the non-clinical running of it for the next 25 years, including catering, laundry, portering, domestics, estates and building maintenance, plus transport, energy supply and telecommunications. The Dartford & Gravesham NHS Trust would retain direct control of all clinical healthcare services.

- Darent Valley Hospital has replaced three old hospitals - West Hill, Joyce Green and Gravesend. It is district Hospital serving 3 major towns in Kent: Dartford, Gravesham and Swanley.
- The carpet covered, colour schemed corridors of the new hospital gives the impression of a conference centre or a large hotel, rather than a hospital. Nightingale Associates who undertook the design of the Unit's interiors explain that colour has been applied thoughtfully to all areas to contribute to a healing environment and aid wayfinding. The colour scheme is particularly apparent in the Children's Ward whose walls are completely covered in murals of farmyard animals and underwater scenes, hand- painted by the local art college.
- 450 in-patient and intensive therapy beds
- 6 modern operating theatres
- 3 day care theatres
- accident and emergency, elderly care, day surgery and ante-natal care buildings
- out-patient clinics and a day hospital
- separate single-storey child resource centre
- staff accommodation for over 200
- ambulatory care centre, including physio and rehabilitation
- car parking for 1,300 vehicles and a three storey admin block

Landscaping

The landscaping plan for the new hospital was based on:

- ease of access for public and private transport
- a clear and legible site layout
- providing an attractive environment for patients, staff and hospital visitors
- landscaping that matches its rural setting outside Dartford.
- incidental open space and tree preservation

Other, more detailed considerations include the woodland structure itself, nature conservation, footpath and cycle links, roads and car parks, open spaces, courtyards, gardens and storm water disposal.

Resource Use

Carillion introduced an innovative soil stabilisation technique designed to reduce the use of natural resources and save on the extensive import by road of raw materials.

Existing, poor quality soil was impregnated with a lime cement mixture, which caused the ground to harden to considerable strength. This was used in place of the usual special aggregates to form the base on which road surfaces are laid.

Waste Minimisation

In an effort to keep waste to a minimum, 55% of some 1,900 tonnes of materials were segregated into single material bins throughout the construction phase of the project. For example, metal, timber, cardboard/paper, brick/concrete and mixed.

The wheeled bins used at the point of segregation were then moved onto a gantry where they were picked up by a forklift and emptied into larger skips, which were then periodically taken off site. During the construction 46,000m of spoil was excavated along with 28,700m of top soil. All of this material was re-used on site.

The key benefit resulting from this successful "cut and fill" exercise was the fact that very little additional/ new building materials had to be imported on site. Re-use of this material on site, principally through landscaping, construction of bunds and raising the height of the car park, represents an environmental improvement over sending it to landfill, as it reduces the use of natural resources.

In addition to the above benefits, lorry journeys were avoided from not transporting material to site nor disposing of bulk material off site. This resulted in reduced emissions of carbon dioxide and less noise and disturbance for local community.

Carillion recognises when there is an excess of material on site, a more sustainable solution is to match the material generated with building material needs at different construction sites, perhaps on a regional basis. This would ensure that materials are used where they are most needed and for the most appropriate purposes ie. Re-use rather than "downcycling". The good environmental work performed at Dartford was built on at the Princess Margaret Relocation project, Swindon. However, the PMH relocation project took this a stage further by including plasterboard into the segregation categories.

Appendix 6 Patient Health Outcomes

From an article by Jeff Stouffer, AIA, is senior vice president of HKS Inc., an architecture firm with offices in Dallas, Texas; Los Angeles; Orlando, Florida; Atlanta; Richmond, Virginia; Salt Lake City; and Tampa, Florida.

Studies in the United States and abroad demonstrate that reducing stress can accelerate the healing process. In architectural terms, this suggests providing familiar and comforting environments to support healing.

According to Roger S. Ulrich, Ph.D., director of the **Centre for Health Systems and Design** at Texas A&M University, providing daylight and windows with views as well as individual patient control, aids in the healing process.

Ulrich says, "Research shows that intensive care patients in rooms with windows and pleasant nature distractions experienced less anxiety and pain. They were also less susceptible to delirium and... had more favourable postoperative courses."

Today's human-centred care environment incorporates noise control, air quality, thermal comfort, privacy, light, views of nature, colour, texture, and accommodations for families. It involves the five senses of sight, touch, sound, taste, and smell. It also provides a connection with nature via gardens, water, ponds, plant materials, daylight, and fresh air. Patients are made to feel in control of their environment. Positive distractions include music, fountains, art, and entertainment.

Many healthcare providers are incorporating one or all of these concepts in their new facilities. **Health Park Hospital**, completed in 1992 in Fort Myers, Florida, was one of the first hospitals designed to incorporate a human-centred design environment. A central atrium is the focal point of the building. Restaurants and retail shops such as a florist, a gift shop, and a newsstand surround it. A lavish landscaped garden is part of the design, complete with glass-enclosed elevators and a cascading waterfall.

During the day, light pours in from glass walls and skylights. At night, soothing rainbow-coloured ambient lighting illuminates the space. The atrium hosts a variety of events from art shows and children's concerts to health fairs and screenings. The hospital's registration area resembles a hotel check-in desk. Most outpatient testing procedures are just a few steps from the registration area, thus easing stress for patients and family.

Other facilities have followed in this approach to design. The **Baptist Medical Centre** at Springhill in Little Rock, Arkansas is designed as a low-scale, mixed-use medical "village." At the core of the campus is the "village green," with a park-like setting. The new **Intermountain**

Health Care, McKay-Dee Hospital Centre in Ogden, Utah represents a fully integrated health campus incorporating the newest technology, the highest planning efficiencies, operational flexibility, and a human-centred design approach to the interior and exterior environments. All the patient rooms have a view to the mountains, valley, lake, or garden.

According to *A Pattern Language*, Christopher Alexander's in-depth study of human relationships with built environments, when people are healing, they need to have their own things around them.
They need to have as much physical control over their environment as possible including temperature, lighting, privacy, and social interaction. The research also noted that patients with strong social support had more favourable long-term survival rates.

At the **Utah Valley Regional Medical Centre**, one of the few such hospitals in the U.S., parents are permitted to sleep next to their sick infants within the neonatal intensive care unit (NICU) in a medically and environmentally supportive environment. This is known in the industry as "kangaroo care." Two NICU nurseries accommodate 49 babies. Large windows promote healing in a day lit environment when appropriate. Or window shades can provide darkness at any time of day.

Public gathering spaces, day lit waiting areas, and overnight accommodations within all patient care areas enable families to be active partners in treatment. Following birth and recovery, mother and baby can enjoy their time in one of 36 private mother/baby rooms, each with a private bathroom. These rooms are designed to provide a comfortable setting where the whole family can spend time together during the postpartum stay. One nurse cares for both mother and baby in the inpatient setting.

Human-cantered care environment concepts also apply to outpatient care. The Sugarland, Texas location of the state-wide Methodist Hospital System serves as a prototype facility.
This centre is composed of two buildings: the physician's offices and the ambulatory care centre. Uniting them is a two-story, sky lit atrium bringing daylight into the public areas.
A series of gardens surrounding the waiting areas and a reflecting pool are the facility's highlights. This provides patients with a private getaway and landscaped dining areas.
According to James Burnett, a Houston-based landscape architect, gardens can be key in healing. "In a 1995 study," he says, "scholars at the University of California, Berkeley, found overwhelming evidence of the therapeutic effects of gardens."

He continues: "They looked at 24 hospitals. More than 95 percent of the people interviewed reported a therapeutic benefit. After even a short break outdoors, patients, families, and employees reported feeling calmer and more relaxed and productive."

Reducing noise is part of providing a comfortable environment. Many hospitals have reduced overhead paging systems, provided carpeted hallways, and chosen sound-absorbing construction materials to moderate noise and reduce stress.

Colour is also important in healthcare design. Research shows that warm and somewhat muted colours reduce stress. Natural wood and sunlight are used to depict warmth. Another way to reduce stress for patients and visitors is to improve "wayfinding." People like to know where they are going and how to get there.

The site of the Valley Children's Hospital, serving ten California counties, covers more than 52 acres (21 hectares). The hospital's wayfinding program operates both outside and in. A different colour and shape (blue diamonds, green squares, purple circles) identify each of the entries and continue inside the building.

The human-centred care environment isn't just about patients and their families. The concept also extends to their care providers. As an example, a 1,500-square-foot (140-square-meter) fitness area was transformed into a 6,500-square-foot (600-square-meter) state-of-the-art wellness centre for staff at Bayfront Medical Centre. Today, Bayfront offers wellness counselling and education, fitness evaluations, personalized exercise prescriptions, aerobics and other guided exercise programs and weight management, and workman's compensation programs.
At Memorial Hospital West in Pembroke Pines, Florida, care teams for the staff are part of the employee benefits. If a staff member experiences extreme stress, they can call upon volunteers trained in massage, music therapy, and aromatherapy for relief.

At McKay-Dee Hospital Centre, patients and visitors as well as staff will be provided with pagers. This allows mobility anywhere within the healthcare setting. For example, a visitor waiting for a family member in treatment can get gourmet coffee or fresh-squeezed juice from a roving vendor. They can take their beverage to a cosy fireplace setting overlooking the mountains.

"For years, as clinicians and hospital administrators, we thought we knew what was best for the patient," says Patty Harrington, administrator and chief operating officer of McKay-Dee Hospital.

"But, you need to ask the right people — our customers — what they want. Patients tell us they would like to be in a homelike environment. A human-centred care environment provides that for those we serve. It isn't just a healthcare trend. It is the direction of progressive hospital design."

Appendix 7 Case Studies demonstrating low energy design features

1. Alice Turner Branch Library, Saskatoon, Canada

Gross floor area: 1358 m^2
Completed: December 1998
Construction Cost: $2.2 million
Architects: Kindrachuk Agrey Architects Ltd.

- Energy use is 65% lower than the National Energy code for Buildings, and as a result energy costs have been reduced by 48%
- High performance spectrally selective low-e glazing and extensive day lighting.
- Four-pipe fan coil and radiant floor HVAC system eliminates reheat and provides a superior thermal environment and indoor air quality.

Features

- Priority was given to natural lighting, visual comfort and visual access to the outdoors. This has resulted in a superior visual environment this promoting occupant health.
- 100% fresh air for ventilation, eliminating 'inter-zone' cross contamination and promoting high ventilation effectiveness
- Low maintenance and durable finishes are used throughout, and low VOC (volatile organic compounds) materials such as paints and water-base adhesives were employed extensively.
- The building is a wood frame construction over a precast concrete steel floor. The wood framing minimises embodied energy. This wooden structure also reduced site material and simplified construction, thus reducing construction time.
- Occupancy sensors are used to control lighting in most areas.

Savings

- 33% reduction in CO2 levels in comparison to similar buildings
- 34% reduction in air particulates
- Overall lighting densities are 40-50% lower than the recommended level.
- The energy cost is projected at $14,366 compared to $27,404 for a similar building, resulting in an energy cost saving of 48%.

2. The Nottingham Ice Centre

Construction August 1995- June 2001
Construction cost £45M

- All heat and power to the Ice Centre is provided by a city district heating scheme fuelled by a waste incineration plant
- Reduced energy requirements achieved by above standard thermal insulation, high specification thermal glazing, external solar shading installations and extensive use of natural ventilation

3. Sainsbury's at Greenwich

Size 5000 m^2
Construction cost £13 M

- First low energy supermarket - designed to half energy costs and promoting the use of environmentally friendly materials
- The store aims to be up to 50 per cent more energy efficient than a standard supermarket and will incorporate many design features which could become commonplace in food stores in the next century.
- The store is naturally lit by an arching glass and steel roof.
- It is designed with underfloor heating which takes heat from the store's refrigeration systems and reuses it to heat the store; the store is naturally ventilated instead of using 'energy intensive' air conditioning
- Built with reinforced concrete walls so that it is cool in summer yet warm in winter - it acts as a giant storage heater, absorbing heat in the day and releasing it at night.

Appendix 8 The benefits of PFI in construction

From ' Modernising Construction' at http://www.nao.gov.uk/publications/nao_reports/00-01/000187.pdf

- The use of private sector management and business skills incentivised by having private finance at risk
- Transfer of risks to those best placed to manage them
- New and innovative approaches including solutions which do not necessarily require a construction project.
- A focus on customer requirements

Appendix 9 PFI projects currently underway or in the pipeline in London

Trust	Project Description	Capital Value	Contract Complete
Barts and the London NHS Trust	Acute site rationalisation	£620	
University College London Hospitals NHS Trust	Acute rationalisation	£404	10/05/2040
Forest Healthcare NHS Trust	Redevelopment of Whipps Cross Hospital	£184	
Havering Hospitals NHS Trust	Redevelopment of hospital facilities	£156	
Bromley Hospitals NHS Trust	New DGH	£117.90	
Greenwich Healthcare NHS Trust	Refurbishment of DGH	£93.00	
North Middlesex Hospital NHS Trust	Redevelopment of existing site	£73	
King's Healthcare NHS Trust	New Block	£64	10/12/2037
North West London Hospitals NHS Trust	Redevelopment of central Middlesex hospital	£56	
Barnet and Chase Farm Hospitals NHS Trust	Barnet phase 1B	£54	
St George's Hospital NHS Trust	Neurol Cardiac Unit	£49	20/03/2038
Lewisham Hospital NHS Trust	Redevelopment of University hospital	£44	
Barnet and Chase Farm Hospitals NHS Trust	Chase Farm hospital reconfiguration	£41	
West Middlesex University Hospital NHS Trust	Acute rationalisation	£33	
The Whittington Hospital NHS Trust	Redevelopment of acute hospital services	£23	
South West London Community NHS Trust	Redevelopment of Queen Mary's, Roehampton	£20.5	
Newham Healthcare NHS Trust	Rationalisation	£20	
Oxleas NHS Trust	Reprovision of mental health	£15	
East London & the City Mental Health NHS Trust	Mental Health reprovision	£12.08	01/03/2030
Parkside Health NHS Trust	Willesden	£11.00	
Redbridge Health Care NHS Trust	Mental Health reprovision and Geriatric Day Centre	£10.80	

Bromley Hospitals NHS Trust	Managed Equipment Service	£9.80	
Greenwich Healthcare NHS Trust	Managed Equipment Service	£9.50	
Oxleas Healthcare NHS Trust	Erith Health Centre	£4.00	
Enfield Community Care NHS Trust	Elderly Mentally ill home	£3.54	
North West London Hospitals NHS Trust	ACAD equipment	£3.50	
Mayday Healthcare NHS Trust	Front Entrance	£1.80	
West Middlesex University Hospital NHS Trust	MRI	£1.50	
Royal National Orthopaedic Hospital NHS Trust	Scanner	£1.00	01/03/2002

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